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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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VOLUME 15 NUMBER 17/SEPTEMBER 8, 1977

TABLE OF CONTENTS

AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

01 AERONAUTICS (GENERAL) 2209

02 AERODYNAMICS 2210

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

03 AIR TRANSPORTATION AND SAFETY 2214

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION 2215

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command and Tracking* and *32 Communications*.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 2216

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

06 AIRCRAFT INSTRUMENTATION 2218

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

07 AIRCRAFT PROPULSION AND POWER 2218

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

08 AIRCRAFT STABILITY AND CONTROL 2221

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

09 RESEARCH AND SUPPORT FACILITIES (AIR) 2223

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*.

12 ASTRONAUTICS (GENERAL) 2224

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

13 ASTRODYNAMICS 2224

Includes powered and free-flight trajectories; and orbit and launching dynamics.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE) 2225

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air)*.

15 LAUNCH VEHICLES AND SPACE VEHICLES 2225

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

16 SPACE TRANSPORTATION 2227

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING 2228

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 2230

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

19 SPACECRAFT INSTRUMENTATION N.A.
For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

20 SPACECRAFT PROPULSION AND POWER 2230
Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.
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23 CHEMISTRY AND MATERIALS (GENERAL) 2233
Includes biochemistry and organic chemistry.

24 COMPOSITE MATERIALS 2233
Includes laminates.

25 INORGANIC AND PHYSICAL CHEMISTRY 2234
Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.
For related information see also *77 Thermodynamics and Statistical Physics*.

26 METALLIC MATERIALS 2237
Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 NONMETALLIC MATERIALS 2243
Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

28 PROPELLANTS AND FUELS 2245
Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion*.

ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.
For related information see also *Physics*.

31 ENGINEERING (GENERAL) 2247
Includes vacuum technology; control engineering; display engineering; and cryogenics.

32 COMMUNICATIONS 2248
Includes land and global communications; communications theory; and optical communications.
For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

33 ELECTRONICS AND ELECTRICAL ENGINEERING 2254
Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.
For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

34 FLUID MECHANICS AND HEAT TRANSFER 2258
Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.
For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

35 INSTRUMENTATION AND PHOTOGRAPHY 2264
Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.
For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation* and *19 Spacecraft Instrumentation*.

36 LASERS AND MASERS 2266
Includes parametric amplifiers.

37 MECHANICAL ENGINEERING 2271
Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY 2273
Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS 2274
Includes structural element design and weight analysis; fatigue; and thermal stress.
For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

GEOSCIENCES

Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.
For related information see also *Space Sciences*.

42 GEOSCIENCES (GENERAL) 2278

43 EARTH RESOURCES 2278
Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography.*

44 ENERGY PRODUCTION AND CONVERSION 2284
Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

45 ENVIRONMENT POLLUTION 2295
Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

46 GEOPHYSICS 2298
Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.
For space radiation see *93 Space Radiation.*

47 METEOROLOGY AND CLIMATOLOGY 2301
Includes weather forecasting and modification.

48 OCEANOGRAPHY 2305
Includes biological, dynamic and physical oceanography; and marine resources.

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51 LIFE SCIENCES (GENERAL) 2305
Includes genetics.

52 AEROSPACE MEDICINE 2306
Includes physiological factors; biological effects of radiation; and weightlessness.

53 BEHAVIORAL SCIENCES 2307
Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT 2307
Includes human engineering; biotechnology; and space suits and protective clothing.

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Includes exobiology; and extraterrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

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59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL) N.A.

60 COMPUTER OPERATIONS AND HARDWARE 2309
Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering.*

61 COMPUTER PROGRAMMING AND SOFTWARE 2311
Includes computer programs, routines, and algorithms.

62 COMPUTER SYSTEMS 2314
Includes computer networks.

63 CYBERNETICS 2316
Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

64 NUMERICAL ANALYSIS 2317
Includes iteration, difference equations, and numerical approximation.

65 STATISTICS AND PROBABILITY 2319
Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 SYSTEMS ANALYSIS 2320
Includes mathematical modeling; network analysis; and operations research.

67 THEORETICAL MATHEMATICS 2321
Includes topology and number theory.

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Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.
For related information see also *Engineering.*

70 PHYSICS (GENERAL) 2322
For geophysics see *46 Geophysics.* For astrophysics see *90 Astrophysics.* For solar physics see *92 Solar Physics.*

71 ACOUSTICS 2322
Includes sound generation, transmission, and attenuation.
For noise pollution see *45 Environment Pollution*.

72 ATOMIC AND MOLECULAR PHYSICS 2323
Includes atomic structure and molecular spectra.

73 NUCLEAR AND HIGH-ENERGY PHYSICS 2325
Includes elementary and nuclear particles; and reactor theory.
For space radiation see *93 Space Radiation*.

74 OPTICS 2325
Includes light phenomena.

75 PLASMA PHYSICS 2328
Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

76 SOLID-STATE PHYSICS 2332
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

77 THERMODYNAMICS AND STATISTICAL PHYSICS 2336
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

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Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
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81 ADMINISTRATION AND MANAGEMENT 2336
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83 ECONOMICS AND COST ANALYSIS N.A.
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE N.A.
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 2338
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) 2340

89 ASTRONOMY 2340
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS N.A.
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 2341
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 2341
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 2342
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

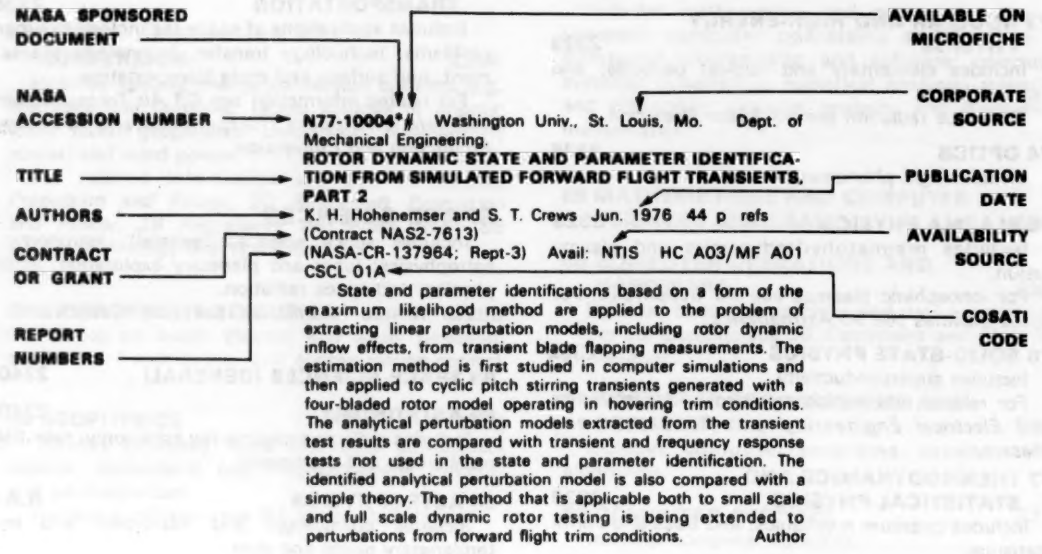
GENERAL

99 GENERAL 2342

Note: N.A. means that no abstracts were assigned to this category for this issue.

SUBJECT INDEX I-1
PERSONAL AUTHOR INDEX I-45
CORPORATE SOURCE INDEX I-53
CONTRACT NUMBER INDEX I-67
REPORT/ACCESSION NUMBER INDEX I-71

TYPICAL CITATION AND ABSTRACT


NASA SPONSORED DOCUMENT
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N77-10004*# Washington Univ., St. Louis, Mo. Dept. of Mechanical Engineering.
TITLE
ROTOR DYNAMIC STATE AND PARAMETER IDENTIFICATION FROM SIMULATED FORWARD FLIGHT TRANSIENTS, PART 2
PUBLICATION DATE
AUTHORS
K. H. Hohenemser and S. T. Crews Jun. 1976 44 p refs
CONTRACT OR GRANT
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(NASA-CR-137964; Rept-3) Avail: NTIS HC A03/MF A01
CSCL 01A
COSATI CODE
State and parameter identifications based on a form of the maximum likelihood method are applied to the problem of extracting linear perturbation models, including rotor dynamic inflow effects, from transient blade flapping measurements. The estimation method is first studied in computer simulations and then applied to cyclic pitch stirring transients generated with a four-bladed rotor model operating in hovering trim conditions. The analytical perturbation models extracted from the transient test results are compared with transient and frequency response tests not used in the state and parameter identification. The identified analytical perturbation model is also compared with a simple theory. The method that is applicable both to small scale and full scale dynamic rotor testing is being extended to perturbations from forward flight trim conditions. Author

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, AN AERODYNAMIC ANALYSIS OF DEFORMED WINGS IN SUBSONIC AND SUPERSONIC FLOW 14802-A-E
J.E. BURKHALTER, Auburn University, School of Engineering, *Auburn, Alabama* 36830 (DA0F8923; DAAG29 77 G0069)

To develop an analysis for deformed wings including camber and thickness for both subsonic and supersonic flow. Relevance - the work is highly relevant to the problem of maintaining control of missiles in extremely high g maneuvers.

Appropriate aerodynamic coefficients such as lift coefficient, induced drag, pitching moments, aerodynamic centers and hinge moments will be computed and compared with experiment where applicable. Potential flow theory will be utilized to model the basic flow field with special techniques being used to account for interference, deformations, camber, twist and thickness.

ADDENDA: Supporting agency address is: DARCOM Army Research Office, Box 12211, Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

1.0002, HEAD-UP COCKPIT DISPLAY DEVELOPMENT FOR FUTURE NAVAL AIRCRAFT B
D. CLOSE, Hughes Aircraft Company, *Malibu, California* 90265 (DN681112; N62269-75-C-0299)

To demonstrate capability of a holographic lens system and initiate associated material and design improvements. A model holographic lens system will be developed to interface with the Navy's acousto-optic deflection system to form a laser head-up display. This contract supports work unit DK210, agency accession no. DN 233231.

Conduct development of holographic materials and hologram formation techniques. Investigate and develop special control methods to produce a transmission simulated array hologram. This continuous lens will be designed to comply with NADC specifications for a hologram lens as a design goal.

ADDENDA: Supporting agency address is: Naval Air Development Center, Sys. Aalysis and Eng. Dept., Warminster, PA

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0003, DEVELOPMENT OF LIGHTWEIGHT HYDRAULIC SYSTEM PUMP FOR FLIGHT TESTING (PHASE II)
B.L. FUHRMAN, Abex Corporation, *Oxnard, California* 93030 (DN681281; N62269-75-C-0300)

Develop and fabricate a prototype high-pressure hydraulic pump for flight testing the lightweight hydraulic system (LHS) and the advanced flight control actuation system (AFCAS) in the T-2C aircraft. This contract supports work unit ZA101, agency accession no. DN681080.

Fabricate parts to design requirements and assemble pump. Perform evaluation tests to verify design.

ADDENDA: Supporting agency address is: Naval Air Development Center, Air Vehical Technology Dept., Warminster PA

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0004, HOLOGRAPHY FOR RECOGNITION TRAINING
A.H. RODEMANN, U.S. Navy, Physical Sciences Laboratory, *Orlando, Florida* 32813 (DN494036)

To provide a 360 deg holographic display for use in a variety of training device applications. Investigations will be undertaken to create effective 360 deg x 360 deg views in both outside-in and inside- out formats (outside-in refers to a complete view of an object, and inside-out refers to a complete panoramic view from a single position). A training application to be developed under this project is that of providing an effective target recognition device. The visual display will consist of one or more holograms of each desired target that will have the property of showing it from any aspect angle. This display can be utilized for an unprogrammed air combat maneuvering trainer. The system will be semiportable including a suitable illumination device for displaying the 360 deg hologram and a library of target holograms.

Develop efficient methods for production of 360 deg holograms. Investigate means for maximizing brightness, resolution, and angular coverage of 360 deg holograms. Investigate utilization of various holographic film materials for the production and reproduction of 360 deg holograms. Investigate means of efficiently illuminating and displaying 360 deg holograms for classroom use. After optimization of various parameters, construct a feasibility model of a display system for target recognition trainer, together with several 360 deg target holograms.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Instrumentation and Flight Controls, Washington, D. C. 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0005, BALLISTIC STRUCTURAL DAMAGE OF AIRCRAFT
J.M. SANTIAGO, U.S. Army, Ballistic Research Labs., *Aberdeen Proving Ground, Maryland* 21005 (DA0N4441)

The objective of this task is to develop analytical methodologies to predict the structural damage inflicted on in-flight maneuvering aircraft by blast and fragments. The methodologies would be developed for ultimate use as tools for vulnerability assessment and hardening redesign.

The most advanced finite-element structural dynamics program capable of treating the nonlinear inelastic transient response of aircraft-like structures will be acquired. It will be modified and specialized as needed to treat damage effect and flight loads on typical fuselage bays and wing sections.

ADDENDA: Supporting agency address is: DARCOM Ballistic Rsch. Labs., Aberdeen PG, MD 21005

SUPPORTED BY U.S. Dept. of Defense - Army

1.0006, REMOTELY PILOTED VEHICLE (RPV) ACTUATOR DESIGN
C.E. CLIFT, Montevideo Technology Inc., *Montevideo, Minnesota* 56265 (DA0D4091; DAAJ02-77-C-0008)

To develop lightweight, low-cost, electromechanical rotary actuators suitable for use in both rotary and fixed-wing RPVS that weigh from 120 to 300 pounds.

To design, fabricate, and test two sizes of flight control actuators for small Army RPVS in accordance with the specifications.

ADDENDA: Supporting agency address is: AVSCOM Air Mobility R&D Lab., Eustis Dir., Ft Eustis, VA 23604

SUPPORTED BY U.S. Dept. of Defense - Army

1.0007, DEVELOPMENT OF AIR DYNAMOMETER DESIGN DATA

W.P. SULE, U.S. Navy, Air Engineering Center, *Lakehurst, New Jersey* 08733 (DN696015; N68335-75-C-2098)

To develop air dynamometers for use as load absorbing devices for the ground testing of turboshaft engines.

Analytical and model testing will be used to advance the state-of- the-art in air dyno technology to produce the design data needed to develop future test systems as new engines become operational.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0008, NONDESTRUCTIVE EVALUATION OF AIRFIELD PAVEMENTS

J.P. NIELSEN, Univ. of New Mexico, Graduate School, *Albuquerque, New Mexico* 87106 (102026 (HRB NO.))

A nondestructive vibratory technique is used to evaluate the load- carrying capacity of existing rigid and flexible airfield pavements. A trailer-mounted mobile vibratory unit is assembled for extensive field utilization. Theoretical analysis of layered pavement systems to obtain dispersion curves has been completed. The device has been transferred to Air Force Civil Engineering for field testing and evaluation of the pavement load rating system developed. A small air-portable nondestructive device is now being developed.

ADDENDA: Document provided to S.S.I.E. by the H.R.I.S.

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0009, LAMINATED WING STRUCTURES

J.B. MONFORT, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF140090)

There is a continuing need to reduce costs and improve the structural efficiency of advanced military aircraft. Conventional design and construction techniques have been virtually pushed to their limits, with further improvements dependent almost entirely upon development of new alloys and material systems. The objective of this effort is to evaluate innovative design and fabrication techniques wherein additional system advantage can be achieved through laminating aluminum sheet by adhesive bonding to reduce acquisition and life cycle costs concurrently with weight savings and increased damage tolerance of primary airframe structure. The combination of economic and performance benefits realizable from improved airframes will provide the Air Force with a valuable tool for accomplishing the assigned mission with critical resources.

The Air Force Flight Dynamics Laboratory and the Air Force Materials Laboratory are jointly sponsoring contract F33615-75-c-5178 with General Dynamics/Fort Worth, MASIS accession number 678180, to design, fabricate and evaluate an adhesively bonded, laminated aluminum stub wing box based on the F-16 design criteria. As an integral part of this program three such wing boxes will be tested by the AFFDL, with non-destructive evaluation support from AFML, at Wright-Patterson AFB, for static strength, fatigue and damage tolerance. All data and the wing boxes shall be returned to the contractor for analysis and inclusion of results in their final technical report.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FBSB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0010, APPLICATION OF CATALYTIC COMBUSTION TO GAS TURBINE ENGINES

T.J. ROSFJORD, U.S. Air Force, Aero Propulsion Lab., *Dayton, Ohio* 45433 (DF458230)

The objective of this work unit is to investigate the application of catalytic combustion to the primary combustor and afterburner of gas turbine engines. Goals of improved combustion performance and low exhaust emissions over the entire operational range of these components will be pursued.

Previous investigations have substantiated the feasibility of catalytic combustion at conditions simulating high-power operation of a gas turbine engine. This program will expand the data base for catalytic combustion in both low- and high-power modes through experimental investigations conducted in Room 20, Bldg. 18C (see work unit 30480542). The ability of a catalyst to ignite and promote the combustion of a fuel/air mixture in an afterburner will be experimentally investigated in a J85 gas turbine engine mounted on Test Stand C, Bldg. 71A (see work unit 30660532). To expand the basic knowledge of catalytic combustion processes, a fundamental research program will investigate the surface reactions on a catalytic flat plate in a combustion tunnel installed in Room 20, Bldg. 18C (see work unit 30480542).

ADDENDA: Supporting agency address is: AF Aero-propulsion Laboratory SFF, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0011, SERVO-CONTROLLED RAPID RESPONSE ANTI-G VALVE SYSTEM

R.J. CROSBIE, U.S. Navy, Crew Systems Department, *Warminster, Pennsylvania* 18974 (DN681267)

To determine, by analysis and demonstration, the feasibility of increasing the protective value of the anti-g suit to pilots during rapid-onset high g profiles by the use of an independently controllable anti-g valve system, and to demonstrate the effectiveness of this system as the only viable method of suit pressurization regardless of the pilot's angle of supination.

A servo-controlled rapid response anti-g valve system, compatible for aircraft installation, will be developed and evaluated. Manned studies on the NAVAIRDEVCEN centrifuge will determine the time history of increased body pressures caused by body fluid shifts during rapid- onset g profiles. The servo-controlled anti-g valve system will be programmed to inflate the subject's anti-g suit on a schedule to precisely counteract these fluid shifts. Manned investigations will be conducted on the centrifuge to determine the optimal anti-g suit pressurization schedule for various g profiles. A method will subsequently be developed for automatically controlling the anti-g valve system using aerodynamical derivable signals other than g. Manned tests will also be conducted at various angles of pilot supination.

ADDENDA: Supporting agency address is: Naval Air Development Center, Warminster PA

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0012, DEVELOPMENT OF AIRCRAFT ELECTROMAGNETIC SCATTERING PREDICTION TECHNIQUES

R. HAYES, U.S. Navy, Aero Electronic Tech. Dept., *Warminster, Pennsylvania* 18974 (DN681006)

The objective is to develop and implement comprehensive EM (electromagnetic) analysis techniques that will allow the prediction of the radiation patterns of antennas located on Navy airborne platforms. Recent scattering studies have been analytical tools which can be applied to pattern prediction to calculate the patterns of aircraft antennas to within plus or minus DB amplitude accuracy including both the depth and positioning of pattern nulls. Avionic system performance depends upon precise antenna pattern coverage and perturbations in patterns due to aircraft scattering degrade system performance. This prediction capability will allow tailor-made antenna patterns and optimization of antenna locations.

EM analysis techniques including the geometrical theory of diffraction, the physical theory of diffraction, and moment matching will be investigated to eliminate inaccuracies which exist in current analysis techniques and broaden the range of applicability. These techniques will be incorporated into a generalized system of computer programs which can be used universally by all activities with compatible computation facilities. These programs will be structured such that each new development and expansion of the theory can be readily incorporated. Complete manuals describing the application of these analysis techniques to the solution of practical antenna problems will be prepared to facilitate an efficient dissemination to other activities.

ADDENDA: Supporting agency address is: Naval Air Development Center, Warminster PA

SUPPORTED BY U.S. Dept. of Defense - Navy

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, TWO-PHOTON PHOTODISSOCIATION OF SMALL MOLECULES
W.M. JACKSON, Howard University, School of Liberal Arts, *Washington, District of Columbia* 20001 (CHE75-12848 A02)

This research is designed to study two-photon photodissociation reactions of simple molecules. The undoubled or doubled output of a high-powered pulsed tunable dye laser is used to initiate the two-photon photodissociation of simple molecules such as cyanogen, ammonia, water, methane, etc. Radiation from any electronically excited fragments is detected using signal averaging techniques. Ground-state fragments can be excited with a second tunable dye laser so that laser-induced photoluminescence spectra may be obtained. Both techniques are being used to study the wavelength dependence of the photodissociation process and thus to obtain information about the excited states that lead to two-photon photodissociation.

In addition to providing fundamental information about dissociative electronic states of molecules, the methods are being used as a source of free radicals. With the experimental arrangement, it is possible to study such processes as rotational quenching of reaction products and free radical addition reactions. The reaction rates can be measured for specific rotational and vibrational levels of the radicals so that detailed information is obtained about the appropriate rate constants. This kind of kinetic information is extremely important in understanding the processes that occur in laser isotope separation, in laser fusion, in free radical combustion reactions, and reactions occurring in nuclear fireballs.

SUPPORTED BY U.S. Natl. Science Foundation

3.0002, TRANSPORT PROPERTIES OF DILUTE CADMIUM AND MAGNESIUM ALLOYS
A.N. GERRITSEN, Purdue University, School of Science, *Lafayette, Indiana* 47907 (DMR73-02651 A01)

Experimental investigations of the transport properties of metals previously supported by NSF grant DMR73-02651 will be continued. The zero field resistivity, thermal conductivity and thermoelectric power of extremely pure cadmium and zinc crystals will be measured. The effect of minute but controlled impurity concentrations on the above properties will be investigated.

SUPPORTED BY U.S. Natl. Science Foundation

3.0003, MIXED CONDUCTION IN DOPED BETA-ALUMINA
R.W. VEST, Purdue University, School of Engineering, *Lafayette, Indiana* 47907 (DMR76-02637 A01)

Studies of ionic and electronic conductivities in beta-alumina doped with multivalent transition metals will be continued. Polycrystalline specimens will be prepared and doped with iron. Electrical conductivity and charge transfer measurements will be carried out as a function of temperature from 100 degrees C to at least 500 degrees C using cell geometries which insure that the material is always in a thermodynamically defined state.

The results should help to settle current scientific controversies concerning the variations in sodium concentration and the mechanism of superionic conductivity in beta alumina. The feasibility of using doped beta alumina as a cathode for sodium/sulfer batteries, as electrodes for a low-temperature oxygen sensor, and as a solid-state memory will be investigated.

This is a renewal of NSF Grant DMR76-02637.

SUPPORTED BY U.S. Natl. Science Foundation

3.0004, THEORETICAL STUDIES OF INTERSTITIAL CARBON AND NITROGEN ATOMS IN METALS
R.J. HARRISON, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0F4796)

The objective is to obtain a theoretical description of the electronic structure and interactions of carbon and nitrogen atoms in interstitial positions in steels and other transition metals and alloys.

Advanced quantum theoretical methods will be used in this study. Experimental data of various types will be used to make a detailed check on predictions of theory. This data includes results of measurements involving electrical resistivity, X-ray analysis, Mossbauer effect studies, nuclear magnetic resonance, ESCA, internal friction, etc.

ADDENDA: Supporting agency address is: DARCOM Materials & Mechanics Res. Ctr., Attn- AMXMR-D, Watertown MA 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0005, SCATTERING THEORY AND CALCULATIONS FOR CHEMICAL REACTIONS AND ELECTRON IMPACT PROCESSES
D.G. TRUHLAR, Univ. of Minnesota, School of Chemistry, *Minneapolis, Minnesota* 55455 (CHE75-06416 A02)

Dr. Truhlar intends to continue and expand a research project whose range goals are as follows: (1) the development of new methods of calculating cross sections for chemical reactions and for electron scattering processes; (2) the testing of old and new methods of calculating properties of collision processes by making calculations to be compared with reliable results in cases where such results can be obtained; (3) the use of reliable theories for making systematic studies of the detailed dynamics of important or representative collision processes.

He plans to pursue the following research topics next: (1) New techniques for the solution of rearrangement scattering problems; (2) development of the basis-set approach to scattering problems; (3) study of the effects of potential-energy-surface variations on the attributes of chemical reactions; (4) quantum effects on the reaction I plus H2; (5) scattering of K, Na, and Mg ion by H and H2; (6) electronmolecule elastic scattering and vibrational excitation at intermediate energies using model potentials. This research is a continuation of that currently supported by Foundation grant, GP-28684A1.

SUPPORTED BY U.S. Natl. Science Foundation

3.0006, OPTICAL STUDY OF GAS-PHASE IONS
R.C. DUNBAR, Case Western Reserve Univ., Graduate School, *Cleveland, Ohio* 44106 (CHE75-13770 A02)

Promising new spectroscopic and photochemical approaches to the study of gas-phase ions are being further developed and applied to a variety of ion systems. Photodissociation spectroscopy is used as a tool for examining the structures and excited electronic states of a variety of cations: application of new dye-laser technology will make it possible to obtain ion spectra at resolutions better than 1 A. Competitive photodissociation channels are being examined as a stringent test of unimolecular decay theory in ion fragmentation processes, and the dynamics of the photodissociation process is studied by examining the angular dependence and velocity distribution of photofragments. Fluorescence of ions is being explored as a potentially powerful means of studying optical properties of reactive gas-phase ions. Two different means of exciting fluorescence are being pursued, one involving preparation of the excited state of the ion by direct photoionization of the neutral, the other using pulsed laser excitation of the ground-state ion. This grant is for renewed support of the research initiated under the support of NSF grant GP-33521X.

SUPPORTED BY U.S. Natl. Science Foundation

3.0007, DETERMINATION OF CONSTITUTIVE EQUATIONS FOR TITANIUM ALLOYS APPLICABLE TO SHEET METAL FORMABILITY
J.F. THOMAS, Wright State University, School of Science & Engin., *Dayton, Ohio* 45431 (DF047860; AF-AFOSR-3252-77)

AF function - the US Air Force has embarked on a long-term integrated computerided manufacturing program aimed at increasing industrial productivity and cost effectiveness of aircraft manufacturing. Opportunity - one component of this program is the development of analytical models for both material behavior and deformation processes which could be integrated into software systems for computer-aided design and manufacturing systems. The defining and measuring of sheet metal formability, and the determination of constitutive equations for high-strength alloys are important to the success of the above program. Objective - this research will establish the range of conditions for which a constitutive equation can be determined, and identify the history-dependent state variables for the commonly used titanium alloy Ti-6Al-4V. How work contributes - this research will parallel work on formability criteria based on calculated forming limit curves as well as work on sheet metal process modeling being undertaken within the Metals and Ceramics Division of the Air Force Materials Laboratory.

Load relaxation studies will be utilized to determine the range of conditions for which a constitutive equation can be identified. Resulting flow characteristics will be analyzed within the constitutive equation framework developed by E. W. Hart which is based upon one or more structure-dependent state variables. One objective of the work will be to determine the effect of phase distribution in the two-phase Ti- 6Al-4V on material parameters and structure-dependent state variables within the constitutive equation.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NE, Bldg. 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0008, DEVELOPMENT OF A PROCESS FOR PRODUCING THE HIGH-ENERGY MISSILE FUEL-TETRA-HYDRO-NORBORNADIENE DIMER

A. SCHNEIDER, Sun Oil Company, *Marcus Hook, Pennsylvania* 19061 (DF457270; F33615-74-C-2064)

To develop a continuous process for the production of a blend of tetrahydro-norbornadiene dimers which will have superior low-temperature properties over the current state-of-the-art RJ-5.

The initial phase of this program will center around bench-scale laboratory tests to determine the optimum conditions which will favor the desired isomers for the following process steps: (1) purification of the raw material, (2) dimerization of the raw material, (3) hydrogenation of the dimer, (4) cleanup of the product, and (5) final purification of the product. Following this analysis, the next phase will involve scale-up to production and fabrication of a 100-500 gal/day production unit. The final phase involves the production of 2000 gallons of the fuel for AFAPL developmental evaluation.

ADDENDA: Supporting agency address is: AF Aero-propulsion Laboratory SFF, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0009, QUANTUM CHEMISTRY OF SMALL MOLECULES

E.R. DAVIDSON, Univ. of Washington, School of Arts & Sciences, *Seattle, Washington* 98105 (CHE76-84036)

Davidson will continue his work on potential surfaces and excited states, and begin research in theoretical x-ray photoelectron spectroscopy. Triatomic potential surfaces (especially for excited states) are of great practical interest because of work in plasmas, lasers, and atmospheric pollution. Theoretical calculations of the potential surfaces for several of the more interesting triatomics will aid in building experience in the types of topographic features which can be presented. The HCO radical is of great importance in flames, and calculations of its quite complex excited-state potential surfaces will be undertaken. Similar studies are planned for other triatomic radicals such as HNO, CH2, etc., of importance in hydrocarbon fuel combustion in air. X-ray photoelectron spectroscopy is an important experimental tool in studies of the electronic structure of molecules, but interpretations of the spectra still leave many unanswered questions. Studies are underway on the X-ray extended fine structure of Br2, C12, and F2, and on the satellite structure of ethylene. Projects to be initiated under this grant include application of discrete basis function methods to calculations of intensities of primary spectral peaks associated with core-hole and valence hole states of neon, carbon monoxide, ethylene, and acetylene.

SUPPORTED BY U.S. Natl. Science Foundation

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, LOW LIFE CYCLE COST COOLER FOR AIR LAUNCHED MISSILES

S.E. SPENCER, Hughes Aircraft Company, *Culver City, California* 90230 (DF137070; F33615-76-C-3096)

The problem to be solved by this effort is one of logistics and finite operational life of sidewinder-type infrared air-to-air missiles. Present air-to-air missiles use open-cycle j-t cooling or thermoelectric cooling. The j-t cooler has a finite operational life because of high- pressure gas storage limitations and high logistics costs because of the need for very clean high-pressure gas at remote operational sites. The thermoelectric coolers can not provide temperatures low enough for the desired sensitivity of IR guidance devices. The objective of this effort is to develop a low-life-cycle-cost closed-cycle cryogenic cooler for sidewinder-type infrared air-to-air missiles. A closed-cycle cooler can be operated for long periods of time and eliminates the logistics problem of providing clean dry nitrogen at remote operational sites.

A split-system low-life-cycle-cost closed-cycle cooler will be developed and configured for the AIM 9l sidewinder missile. The cooler and its supporting electronics will be subjected to extensive environment, performance and life tests and then transitioned into Air Force air-to-air missiles.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FEE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0002, ADVANCED TECHNOLOGY AND DEVELOPMENT FOR AIR FORCE FLIGHT DYNAMICS SYSTEM PROBLEMS

C.T. LEONDES, Univ. of California, School of Engin. & Appl. Sci., *Los Angeles, California* 90024 (DF139380; F33615-76-C-3009)

This program is for research and development in advanced control theory and technology for application to advanced vehicles and control system problems. This program will help to solve existing Air Force problems. The objective of this program is to formulate a functional flight control design. This new design can be utilized on new aircraft systems such as AFTI.

Eleven tasks or study efforts will be investigated. Five of these tasks are essential to preliminary design of an AFTI-type vehicle and will be emphasized. These are sub-optimal control theory for precise terminal control problems as applied to air combat or air-to-ground role. New mathematical approaches will be utilized which may tend to produce new methods to solve existing flight dynamics problems.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FG, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0003, BASIC AND APPLIED STUDIES OF NOISE

W.C. REYNOLDS, Stanford University, School of Engineering, *Palo Alto, California* 94305 (ENG76-00819)

This is to provide continued support at Stanford University on aeroacoustics research. The approach taken is experimental, utilizing a new internal flow aeroacoustic facility in which flow and acoustic efficiency measurements for square-edged metering orifices have already been made. The same facility, basically a very long four-inch PVC pipe with anechoic terminations, has been used to develop a new method for measurement of acoustic reflection from obstruction in pipe with flow.

New methods of noise measurement, specifically for use in internal flows, are being developed with emphasis on the problems of (1) separation of acoustic pressure from pseudosound, (2) mode recognition correlation of signals from wall pressure sensors displaced axially along the pipe and about the circumference of the pipe at a given station and (3) identification and separation of combined noise sources (jet, shear layers, wall pressure fluctuation, etc.) by combined use of velocity sensors (hot-wire anemometers) and wall pressure sensors at separate locations. These techniques are particularly important for the study of the basic sound-generation mechanisms in internal flows.

SUPPORTED BY U.S. Natl. Science Foundation

4.0004, GAAS HIGH-TEMPERATURE ELECTRONIC DEVICES
D.H. GRANTHAM, United Technologies Corp., *Hartford, Connecticut* 06108 (DN590197; N00019-76-C-0673)

The objective of this program is to determine the feasibility, governing parameters and limitation of GaAs power switching devices for applications in severe, high-temperature, avionic electronic control system.

In order to achieve this objective a current switch for the 28-volt range which can control one-ampere direct current via a -10v gate signal and can operate at elevated temperatures will be fabricated. This device will be life tested at 200 deg C for a period up to 2000 hours.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, DC 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0005, INVESTIGATION OF AERODYNAMICALLY INDUCED VIBRATIONS
S. FLEETER, General Motors Corporation, *Indianapolis, Indiana* 46206 (DF046830; F49620-77-C-0024)

AF function - advanced turbomachinery. Opportunity - develop predictive capability for blade flutter. Objective - develop a valid, experimentally verified, quantitative basis for the design of turbomachinery blades that are free of high-magnitude, aerodynamically induced, integral order stresses. How work contributes - this work will permit designers to more accurately consider aerodynamic flutter in the design of advanced turbomachinery.

The DDA low-speed, large-scale, single-stage research compressor will be used to investigate the effect of rotor-stator axial spacing on the fundamental unsteady aerodynamic phenomena in the vane row generated by the passage of the rotor wakes. The experimental data will be analyzed and correlated with appropriate state-of-the-art analyses.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NA, Bldg. 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0006, BASE-MOUNTED ANTENNA FLIGHT INSTRUMENTATION (BAFI)
A. SINDORIS, U.S. Army, Harry Diamond Laboratories, *Hyattsville, Maryland* 20783 (DA0F5673)

To provide the required antenna support for the BAFI flight test program which includes the RF feed components needed for the instrumentation package.

Check out an existing base-mounted antenna design that uses air- filled and foam-filled cavities. Design RF feed and reflectometers.

ADDENDA: Supporting agency address is: DARCOM Harry Diamond Laboratories, 2800 Powder Mill Road, Adelphi MD 20783

SUPPORTED BY U.S. Dept. of Defense - Army

4.0007, BOUNDARY LAYER AND WAKE MODIFICATIONS TO COMPRESSOR DESIGN SYSTEMS
J.L. KERREBROCK, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (DF460690; F33615-76-C-2118)

To devise a model for a turbomachine stage in which the radial transport of momentum and energy by the boundary layer and wake flows are accounted for approximately, so that cascade throughflow design techniques can be applied rationally without ad hoc corrections for these effects. A fast running computer code will be developed which is suitable for routine design and analysis.

The elements of rotor boundary layer and wake transport will be added to an existing throughflow-cascade model, calibrated and compared to detailed experimental data. Further data will be explored to examine radial distributions of work and meridional velocity. Radial transport effects of wakes between rotor and stator and in the stator will be added to the model and further compared to experimental results.

ADDENDA: Supporting agency address is: AF Aero-propulsion Laboratory TBC, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0008, FUSION CASTING FLUORIDES
J. PAPPIS, Raytheon Company, *Waltham, Massachusetts* 02154 (DF901450; F19628-76-C-0279)

AF function - weaponry. Deficiency - inability of currently available materials for laser windows to passively withstand laser power. Objective - to use fusion casting of alkaline earth fluorides to produce low-absorption, high-strength laser windows. How research contributes - alkaline earth fluorides are leading candidates as laser window materials. This contract will optimize casting procedures and purification techniques for calcium fluoride, strontium fluoride and barium fluoride to produce 15 cm diameter laser windows having high strength, low absorption and low residual strain.

The approach to this research is to simultaneously purify and cast the alkaline earth fluorides in the same apparatus using reactive and nonreactive atmospheres. Castings will then be characterized to determine impurity content and optical absorption.

ADDENDA: Supporting agency address is: Rome Air Development Center ETS, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0009, OPTICAL WAVEGUIDE COUPLING
W.S. CHANG, Washington University, School of Engin. & Appl. Sci., *St. Louis, Missouri* 63130 (DF246390; F19628-76-C-0032)

AF function - communications technology. Deficiency or opportunity - problems of security, susceptibility to electromagnetic interference and inadequate signal bandwidth. Objective - to develop new light coupling technique effectively between optical fibers and GaAs thin-film waveguides. How research contributes - efficient coupling technology is necessary so that new integrated optics components can be used in optical circuits. Minimizing coupling losses will also allow more sub- stations in optical fiber communications systems.

A tapered transitional waveguide (tapered high-refractive-index film with low-index substrate) will be used to couple into the fiber. This has the advantage that phase matching is achieved automatically by the taper and that no critical mechanical alignment is involved. The difficult task of coupling between the tapered transitional waveguide and the GaAs waveguide (because GaAs has the highest refractive index of all the materials transparent in the near infrared) can be solved via a second taper or by end excitation.

ADDENDA: Supporting agency address is: AF Cambridge Research Laboratories LQ, L.G. Hanscom AFB, Bedford, MA 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0010, STUDY OF OPERATIONAL FAILURES IN NAVAL AVIONICS
J. BAUER, U.S. Navy, Air Engineering Center, *Lakehurst, New Jersey* 08733 (DN796005)

Develop an understanding of the relative contribution to system failure made by parts failures versus other factors (such as noise, coupling or mechanical wear).

This is to be done by performing failure analysis on failed avionic components to obtain an understanding of the causes. This information will be used to specify failure detection and procedures.

ADDENDA: Supporting agency address is: Naval Air Systems Command, Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0011, INCOMPRESSIBLE AXISYMMETRIC WAKES

F.R. HAMA, Princeton University, School of Engin. & Appl. Sci., *Princeton, New Jersey* 08540 (ENG76-21913)

This is a renewal of NSF Grant ENG74-21490. The research to be continued will be on the instability, vortex formation or shedding, and transition behind an axisymmetric body, particularly ellipsoid of revolution with a variety of eccentricity as well as a slender streamlined body. Detailed near-wake surveys of velocity distribution behind an ellipsoid of revolution were completed near the end of the previous grant period. These data will be reduced and interpretation will be attempted. More specialized experiments will be designed to focus on the mechanics of nonlinear wake development and final breakdown. These latter experiments require new techniques and cannot be done by semi-automatic conventional surveys. The digital processing of data is essential.

SUPPORTED BY U.S. Natl. Science Foundation

4.0012, DESIGN AND FABRICATION OF HARDENED CMOS

S. TEITELBAUM, Radio Corporation of America, *Princeton, New Jersey* 08540 (DF099130; F33615-74-C-1175)

To develop a low-cost, high-speed, radiation-hardened computer fabrication technology using LSI CMOS/SOS technology.

Using CMOS/SOS technology with a radiation-hardened gate insulator (Al2O3) which has been demonstrated to be capable of high total dose radiation levels, fabricate the chips for a radiation-hardened CPU, and then fabricate the CPU. Do performance testing to demonstrate the radiation performance capability of the technology.

ADDENDA: Supporting agency address is: AF Avionics Laboratory DHE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0013, TRANSONIC WING-BODY CALCULATIONS

D.A. CAUGHEY, Cornell University, School of Aero. & Mech. Engin., *Ithaca, New York* 14850 (DN775078; N00014-77-C-0033)

The development of accurate methods for the prediction of the transonic flow fields about complex aircraft and missile configurations is essential for their design and optimization. The proposed research will develop finite-difference techniques for solving the complete potential equation for the transonic flow about three-dimensional configurations, such as wing-fuselage combinations.

The development of accurate predictive techniques for increasingly complex configurations is an evolutionary one. The planned research will extend the previous wing work of Jameson and Caughey to include the added complexity of a fuselage. Emphasis will be devoted to methods for transforming the geometries to computational domains in which the boundary conditions can be accurately and efficiently incorporated. Concomitant problems associated with the transformational procedures (the flow is not approximately aligned with one of the coordinate directions at all points in the field) will be studied. The investigation will be conducted within the framework of the complete potential equation differenced in a non-conservative form.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0014, OPTIMIZATION OF A TRANSPORTATION SYSTEM PLANNING PROBLEM

W.E. WILHELM, Ohio State University, School of Engineering, *Columbus, Ohio* 43212 (DF047450; AF-AFOSR-3230-77)

AF function - the LOGAIR network analysis project and other transportation system problems of interest to the logistics command. Deficiency - for the LOGAIR problem the route structure, schedule, and assignment of aircraft historically have been determined via manual procedures. Currently it is not possible to verify the adequacy of the present system relative to an optimal network structure. Objective - this study addresses the problem of synthesizing a minimum-cost transportation system plan to provide acceptable shipping times for transshipments among a set of points. The research objectives include development of solution approaches and assessment of computation time necessary to solve problems of realistic size. How work contributes - a combination of improved interfacing among routes, better scheduling, and alternative aircraft assignments would significantly alleviate certain performance deficiencies. In particular, 'pipeline' times are considered excessive in light of both customer service standards and the resultant 'inventory float' investment.

Research is proposed to continue algorithm development initiated during the 1976 USAF/ASEE summer faculty program. A unique formulation allows system modeling as a mixed integer linear program. The proposed solution approach applies Bender's decomposition principle to obtain 0,1 integer master problem which designs the network and a linear programming subproblem which prescribes material flows. Primary thrust of the research is to develop a solution algorithm which exploits the special structure of the master problem to achieve reasonable computation time. The general approach indicated includes potential steps to simplify problem complexity, use of bounds available from decomposition and the relaxed problem.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NM, Bldg. 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, GENERAL SUPPORT ROCKET SYSTEM CONCEPT DEFINITION METEOROLOGICAL ANALYSIS

O.M. ESSENWANGER, U.S. Army, Missile Res. Dev. & Eng. Lab., *Huntsville, Alabama* 35809 (DAOF1122)

The objective is to define subsystem and system trade-offs and to select concepts for advanced development prototyping.

The effort will involve a review and analysis of meteorological equipment and systems applicable to General Support Rocket System (GSRS), including surface wind and ballistic meteorological systems. Of primary interest are data accuracies as affected by time and distance.

ADDENDA: Supporting agency address is: MICOM Advanced Systems Concepts Office, US Army MSL RD&E Lab., US Army Missile Command, Redstone Ar., Al 35809

SUPPORTED BY U.S. Dept. of Defense - Army

5.0002, ANALYSIS OF MAGNETIC AND AURORAL DATA FROM THE IMS ALASKA MERIDIAN CHAIN OBSERVATORIES

S. AKASOFU, Univ. of Alaska, Geophysical Institute, *Fairbanks, Alaska* 99701 (ATM76-12259)

In a companion grant entitled 'International Magnetospheric Study (IMS) Alaska Meridian and Longitudinal Array of Magnetometers and All- Sky Cameras', the Geophysical Institute of the University of Alaska will install, maintain and operate magnetometers, all-sky cameras and riometers in a chain of 17 observatories.

This grant will support the processing and analysis of a variety of data taken from the Alaskan meridian chain in order to facilitate studies with satellite and other ground-based data. The project will facilitate a cooperative program with the Environmental Data Service (EDS/NOAA), Space Environment Laboratory (SEL/NOAA) and the two Canadian meridian chains by providing processed auroral and magnetic data to the IMS scientific community. As such this grant will permit the goals of IMS to

be achieved, i.e., coordinated research on magnetospheric dynamics.

SUPPORTED BY U.S. Natl. Science Foundation

5.0003, BASIC INVESTIGATION OF REMOTELY DETECTABLE DEPOSITS OF OIL AND GAS (BIRDDOG)
T.J. DONOVAN, U.S. Dept. of the Interior, Geological Survey, *Flagstaff, Arizona* 86001 (9410-01405)

Objectives for the current fiscal year include refinement of computer-enhancement techniques for LANDSAT data to detect alteration aureoles over petroleum deposits. Investigation of radar techniques for detecting oil seeps at sea will be initiated this year as will the construction of a photo catalog/atlas of alteration phenomena occurring over oil fields.

SUPPORTED BY U.S. Dept. of Interior - Geological Survey

5.0004, VIKING MARS LANDER IMAGING EXPERIMENT
E.C. MORRIS, U.S. Dept. of the Interior, Geological Survey, *Flagstaff, Arizona* 86001 (9580-00757)

The cameras of the two successful Viking Landers took more than 1,000 detailed photographs of the surface of Mars during the primary mission. The primary mission for the Landers began at their successful landings July 20 and September 3, 1976, and ended November 5, 1976, when Mars passed behind the sun and radio communication was no longer possible with the spacecraft. Analysis of the pictures taken during the primary mission will continue during FY 77. The results will be published in scientific journals.

Operation of the Landers was revived in January 1977 when Mars again became visible. Acquisition of data will continue in an extended mission phase for the next two years. Lander imaging experiments will be planned to monitor changes in the atmospheric properties and surface features to better understand the seasonal changes of Mars. Imaging sequence planning meetings will be held monthly during the extended mission.

SUPPORTED BY U.S. Dept. of Interior - Geological Survey

5.0005, REMOTE SENSING APPLICATIONS TO HYDROLOGY AND WATER RESOURCES SYSTEMS
R.H. BURGY, Univ. of California, Agric. Experiment Station, *Davis, California* 95616 (0070038; CA-D0-WSE-3062)

OBJECTIVE: Define the parameters, characterize the requirements and devise the relationships for use of remote sensing inputs to operational tasks in hydrology and water resources systems.

APPROACH: Ongoing studies at the University of California supported by NASA are scoped to yield results directly for use on components of California water resources systems.

SUPPORTED BY California State Government - Sacramento

5.0006, SATELLITE OZONE ANALYSIS CENTER
J.E. LOVILL, Univ. of California, Lawrence Livermore Laboratory, *Livermore, California* 94550 (DOT-FA76NAI-653)

The object of the Satellite Ozone Analysis Center is to take the compressed radiance data in the CO2, H2O and O3 spectral areas between 5-20 microns of the USAF Block 5D meteorological satellite and provide analyzed global data to the scientific community. SOAC will process raw spectral data in the selected spectral regions. SOAC will process all 9.8 microns O3 data and selected CO2 and H2O spectral data. These data will then be subjected to quality control from selected quality Dobson spectrophotometer observations around the world. In 1979 it will be possible to cross-correlate the SOAC data with TOMS data; often SOAC processes and performs quality control on these data. Then these ozone data will be splined and placed in a regular grid - a 2 degrees, 10 degrees and 20 degrees Global Grid. All analyzed data will be sent to the scientific community for initialization of numerical models and for verification of these models. SOAC will also be 1) directing its research toward understanding of long-term global trends in ozone, 2) analyzing anthropogenic and nonanthropogenic events, such as high altitude.

RESULTS: This project is presently being implemented. Jet flights, chlorfluormethane releases, volcanic activity, and solar proton events - to name a few. SOAC will be cooperating in the United Nations WMO GORMP project.

SUPPORTED BY U.S. Dept. of Transportation - O.E.Q.

5.0007, EXPERIMENTAL INVESTIGATION OF SUPERSONIC JET NOISE
R.E. KAPLAN, Univ. of Southern California, School of Engineering, *Los Angeles, California* 90007 (ENG76-22529)

The primary aim of this project is to determine whether the large- scale, coherent structures contribute significantly to the radiated noise of a supersonic jet. Measurement of the far-field noise radiated from a fixed region of the jet will be made to correlate this data with near-field measurements and to identify the latter with the turbulent jet structure.

SUPPORTED BY U.S. Natl. Science Foundation

5.0008, MAGNETOSPHERIC-IONOSPHERIC COUPLING STUDIES WITH THE HOMER AND CHATANIKA RADARS
R.T. TSUNODA, Stanford Research Institute, *Menlo Park, California* 94025 (ATM76-81191)

This grant funds an investigation of the field-aligned current (FAC) system that couples the magnetosphere to the auroral ionosphere. Measurements of the electrodynamic properties of the ionosphere will be made by the backscatter radars at Homer and Chatanika, Alaska, in coordination with FAC measurements by various satellites. The specific questions to be answered are: How is the FAC closed horizontally within the ionosphere (i.e., what is the quantitative and qualitative relationship of FAC to the electrojets)? What is the relationship of the FAC system to the diffuse aurora and to discrete visual arcs? What fraction of the FAC is carried by energetic (keV) auroral electrons?

The Chatanika radar will be used for quantitative measurements of basic ionospheric parameters such as electric fields, conductivities, electrojet currents, and the altitude profile of electron density. The auroral electron energy distribution and the electric current and energy flux carried by these particles now can be inferred from the altitude profile of electron density. The variation of these parameters can be measured by an elevation scan in the meridian plane over a latitudinal extent that includes most of the evening auroral oval.

The Homer radar will be used primarily to determine the spatial distribution of auroral precipitation and electric fields over a large geographical area, with fine temporal resolution. The rapid latitude/longitude mapping of the Homer radar will be used to provide the spatial relationship for a meaningful comparison of data obtained by the Chatanika radar in its meridian with the FAC measurements made by a satellite along its trajectory.

SUPPORTED BY U.S. Natl. Science Foundation

5.0009, LIDAR TECHNIQUES FOR EVALUATION OF AEROSOL, CLOUD AND PRECIPITATION OPTICAL AND PHYSICAL DENSITIES 13833-GS
E.E. UTHE, Stanford Research Institute, *Menlo Park, California* 94025 (DA0E9274; DAAG29 77 C 0001)

Develop and evaluate quantitative techniques for deriving from lidar backscatter signals, atmospheric optical and physical density parameters relating to aerosol, cloud and precipitation distribution. Relevance - the work addresses atmospheric transmission capabilities in the infrared frequency of military interest such as terminal homing and target acquisition devices and laser target designators. It is also important for development of remote ceiling and visibility sensors, chemical agent detectors, pollution monitoring at military arsenals and depots, and development of aerosols to be disseminated for screening purposes.

Reconfigure the wavelength and polarization of the mobile SRI lidar system to increase the capabilities of the lidar for quantitatively specifying atmospheric optical and physical density parameters relating to aerosols, cloud and precipitation distribution in the mesoscale. Develop and evaluate algorithms and processing signature data in terms of absolute atmospheric optical and phsical density information accounting for atmospheric at-

tenuation and scattering effects, and size and shape characteristics of the scattering particles. Evaluate experimentally, via two field programs, the accuracy and limitations of the techniques developed.

ADDENDA: Supporting agency address is: DARCOM Army Research Office, Box 12211, Research Triangle Park, NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

5.0010, VIKING PHYSICAL PROPERTIES

H.J. MOORE, U.S. Dept. of the Interior, Geological Survey, *Menlo Park, California* 94025 (9580-00734)

The Viking Landers have completed their Primary Missions. The period beyond November 1976 has been called the Extended Mission. This project will involve participation in the Extended Mission. Such participation will include planning, execution, and analyses of spacecraft, imaging, and other data relevant to further defining the physical properties of the surface materials on Mars.

SUPPORTED BY U.S. Dept. of Interior - Geological Survey

5.0011, REMOTE SENSING OF OCEAN PROPERTIES BY MEANS OF VISIBLE LIGHT

R.W. AUSTIN, Univ. of California, Scripps Inst. of Oceanography, *San Diego, California* 92038 (7-721; 04-6-158-44033 MOD. NO. 2)

OBJECTIVE: To further the understanding and knowledge in relating remotely sensed multispectral scanner data to primary productivity, phytoplankton stock, chlorophyll-a, dissolved organic material and other suspended particulates.

APPROACH: Multispectral scanner data from aircraft-borne sensors, and the NIMBUS-G Coastal Zone Color Scanner (CZCS) with supportive in- situ physical, biological, and optical ocean measurements will be acquired over ocean waters containing various phytoplankton, and inorganic suspended particulate concentrations. The reduction, analysis and interpretation of these data will be incorporated into theoretical models, and computer analyses will be conducted with respect to 1) the determination of oceanic and atmospheric factors affecting the signal available to a remote ocean color sensor; 2) establishing methods for the determination of atmospheric path radiance and transmittance from shipboard measurements; 3) the development, refinement and application of computer programs for processing data (remotely acquired and in-situ) for modeling the optical properties of the ocean and atmosphere, and for algorithmic calculation of sensor data to maximize extraction of quantitative chlorophyll-a and total suspended particulate concentrations; and 4) improving spectral classification of ocean water types based on multivariate analysis of spectral irradiance data.

PROGRESS: The state-of-the-art for remote sensing of ocean color differences with high spectral resolution has been advancing rapidly in the past year. Progress has been made on the determination of the factors that affect the spectral nature of the radiation generated by the ocean, its surface and bottom, and the manner in which this signal is transmitted by the atmosphere to the sensor. Optical instruments have been built and used to acquire data in the sea and the atmosphere. These data have been used in models to predict the magnitude of spectral signals available to the remote sensor. Sensor data from airborne spectral scanners over various ocean waters have provided initial verification of predictive techniques. Laboratory studies have been made of spectral absorption and scattering properties of different species of phytoplankton and the effects of nutrients on these spectral properties, for utilization in comparison to in-situ conditions.

SUPPORTED BY U.S. Dept. of Commerce - N.O.A.A.

5.0012, WIND SHEAR SENSING

D. BERAN, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (RAA7 06 88)

PROJECT OBJECTIVE: Install and test operational wind shear detection system at Dulles airport. Continue investigations into development of other wind sensing techniques.

CURRENT YEAR PLAN: Optimize current plans, develop alternate systems, fabricate, install and test at Dulles site. Prepare engineering specifications. Consultation and support of FAA activities. Prepare final report, and analysis.

PROGRESS REPORT: System installed. Tests continuing.

SUPPORTED BY U.S. Dept. of Transportation - F.A.A.

5.0013, LASER RADAR MEASUREMENT THEORY

A. COHEN, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8AA70577)

PROJECT OBJECTIVE: Develop methods of remote determination of aerosol parameters of clouds (both natural and manmade) such as particle density, size distribution and refractive index. In addition a measurement of visibility-distance (incorporating multifrequency extinctions) will be achieved.

CURRENT YEAR PLAN: Perform theoretical multiple scattering calculations along with laboratory measurements using a dye-base and a scattering cell containing latex spheres with various concentrations.

SUPPORTED BY U.S. Dept. of Commerce - N.O.A.A.

5.0014, BASIC ENVIRONMENTAL SERVICES

G. LERFALD, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (BAA21239)

PROJECT OBJECTIVE: Provide a unique data set to improve solar radiation models. The effect of aerosols and clouds on solar radiation will be examined and a model proposed.

CURRENT YEAR PLAN: Phase II will apply lidar, acoustic sounder and spectral radiation monitoring equipment at Colstrip, Montana, and Santa Barbara, California. The data will be used to determine cloud and aerosol affects on solar radiation, particularly effects on the direct and diffuse.

PROGRESS RESPORT: Data collected at Boulder which will be analyzed for use in the program. Computer programs used to process the data have been developed.

SUPPORTED BY U.S. Energy Res. & Dev. Admin.

5.0015, NORTH DAKOTA COAL LANDS ENVIRONMENTAL GEOLOGY

D.E. TRIMBLE, U.S. Dept. of the Interior, Geological Survey, *Denver, Colorado* 80225 (9530-01933)

STATES TO WHICH PROJECT PERTAINS: North Dakota.

Regional studies of landslides and areas of potential landsliding will be started. Aerial photographs will be used for initial studies. Photogeologic reconnaissance will be supplemented by field check. Areas of subsidence and potential subsidence will be identified during this same study, and possibly shown on same map--representing unstable ground.

Geomorphological terrain studies will be started simultaneously with the hazard studies if funds and availability of personnel permit. Otherwise they will be deferred until such funds and personnel become available.

SUPPORTED BY U.S. Dept. of Interior - Geological Survey

5.0016, SOUTH TEXAS LINEAMENTS

E.R. VERBEEK, U.S. Dept. of the Interior, Geological Survey, *Denver, Colorado* 80225 (9530-01609)

STATES TO WHICH PROJECT PERTAINS: TEXAS.

Faults previously identified on aerial photographs will be the subject of a continuing mapping effort within 35,000 km2 of the Texas Gulf Coast. Active faults in areas of little fluid production and minimal subsidence will be of particular interest in evaluating the natural contribution to fault motion in the coastal plain. Specific objectives are to determine the pattern and density of faults in the Texas Gulf Coast, to weigh the relative importance of the various factors (water, oil, gas, sulfur production; rising salt domes, differential compaction; creep of sediment pile into Gulf of Mexico) that can contribute to fault activity; and to prepare a detailed fault map for a demonstration mapping effort within the City of Houston, where the effects of fault motion are most detrimental.

SUPPORTED BY U.S. Dept. of Interior - Geological Survey

5.0017, EFFECT OF HALOGENATED GASES ON STRATOSPHERIC AND TROPOSPHERIC PHOTOCHEMISTRY AND THE EARTH'S OZONE BALANCE (ABBREV)
P.J. CRUTZEN, Colorado State University, Graduate School, *Fort Collins, Colorado* 80521 (R804921 01)

A systematic development of numerical models capable of examining the effects of halogenated gases on stratospheric photochemistry and the earth's ozone balance will be undertaken. Because the industrial halogenated gases have their origin at the surface, this research will also be concerned with the fate of these gases in the troposphere. To accomplish this goal, it is important to simulate atmospheric processes as realistically as possible. Therefore, the model should be designed such that exchange mechanisms in the planetary boundary layer, as well as between the troposphere and stratosphere, can be properly simulated. The first step of this modeling effort will be the design and examination of the results of a one-dimensional, time-dependent model. Eventually two- and three-dimensional models incorporating realistic boundary conditions will be developed.

Using the best available chemical kinetic data, a detailed examination of the formation of intermediate halogenated gases which may or may not be removed from the troposphere by heterogeneous processes will be conducted. To obtain a measure of the efficiency of these processes, the numerical simulations will be compared to measurements of the various halogenated gases in the atmosphere.

SUPPORTED BY U.S. Environ. Protect. Agency - O.R.D.

5.0018, WATER SOIL AND PLANT RELATIONSHIPS IN FOREST RESOURCE MANAGEMENT
J.T. MAY, Univ. of Georgia, Agric. Experiment Station, *Athens, Georgia* 30601 (0061829; GEO-0023-MS)

OBJECTIVE: Determine the extent of surface area affected by heavy harvesting, site preparation and planting equipment and the effects on soil physical conditions, plant succession, ecology, and growth of tree seedlings; and study kaolin-mined areas to develop site preparation and fertilization practices that will favor the establishment and growth of vegetational cover and select and test plant species suitable for specific reclamation situations.

APPROACH: Aerial photos and line transects are used to determine areas affected by various harvesting and site preparation operations. Laboratory tests on core samples and on soil in situ will determine changes in soil physical properties. Effects on vegetation, including planted and direct-seeded pines, will be studied through paired plots with data taken at intervals up to 5 years. Grains, grasses, herbs and trees will be planted on kaolin-mined areas in blocks and pairs comparing fertilization and other treatments. Analysis will be made for major and minor elements. Plots will be maintained for 5 years for growth and survival data.

PROGRESS: See sub-projects 23 - A, B.

SUPPORTED BY U.S. Dept. of Agriculture - C.S.R.S.

5.0019, MONITORING AND MODELING THE DISPERSIVE CAPABILITIES OF THE RURAL ATMOSPHERIC PLANETARY BOUNDARY LAYER
E.S. TAKLE, Iowa State Univ. of Sc. & Tech, Agric. Experiment Station, *Ames, Iowa* 50010 (0068379; IOW02116)

OBJECTIVES: 1) Develop mathematical and computer models specifically tailored to rural atmospheric dispersion problems such as transport of odor, pesticides, dust, spores, pollens and other allergens. 2) Carry out remote and in situ measurements of the rural atmospheric boundary layer to obtain a better quantitative understanding of rural dispersion characteristics. Develop a predictive model for growth and decay of nocturnal inversions, and test and modify this using detailed surface, balloon-borne, and remote measurements. Incorporate the results of 2 into the models of objective 1.

APPROACH: Time-dependent dispersion models incorporating gravitational settling and dry deposition will be applied to particle drift problems. Time-independent area source models will be modified to address rural vapor drift situations. Surface observations of temperature, humidity, radiation, wind speed and wind direction will be made. Vertical profiles of meteorological variables and detailed structure of thermal inversions will be obtained from balloon-borne sensors and acoustic echo-sounder. These observations will be used to determine both the climatology and the dynamics of the dispersive properties of the rural atmosphere. Particular attention will be given to the anomalous transport conditions produced by nocturnal inversions. Wind shear, thermal structure, and mixing properties observed during these events together with surface measurements will by used to test predictive models of nocturnal inversion growth and decay.

PROGRESS: Atmospheric boundary-layer stability data being collected continuously on the acoustic echo-sounder reveal considerable structure and diurnal evolution. Post-sunrise growth rates of pollutant mixing depths are being studied and compared with the theoretical dependence, and carbon monoxide, ozone and particulate levels monitored by the Iowa Department of Environmental Quality. The night-to-day transition in atmospheric stability presents difficulties not adequately characterized by current atmospheric dispersion models. This project is attempting to describe the characteristics of this transition period. A climatology of atmospheric stability and dispersive properties for a rural area has been constructed using cloud cover, solar radiation, and vertical profiles of temperature and horizontal wind speed. Diurnal and seasonal influences have been documented. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Agriculture - C.S.R.S.

5.0020, WINTER WHEAT YIELD MODEL FROM SURFACE AND SATELLITE METEOROLOGICAL DATA
A.M. FEYERHERM, Kansas State University, School of Arts & Sciences, *Manhattan, Kansas* 66506 (0067086; KAN-05-392)

OBJECTIVE: Adapt the Canadian multiplicative type weather-spring wheat yield model to winter wheat conditions in Kansas and other Great Plains States; test the ability of such a model to predict point and area-wide (including State) yields at various stages of growth; and test its usefulness in estimating the variance of area-wide wheat production over years due to weather alone. Provide ground truth information and data reduction of ERTS imagery at two locations in Kansas.

APPROACH: The Canadian model will be used to obtain model-derived wheat yields using past historical meteorological data to compare with past observed yields. The model will be modified to reflect effects of diseases, insects, fertilizers, improved varieties, and management practices. Attempts will be made to improve predictive power of the model using satellite-derived data.

PROGRESS: A winter wheat yield model is being developed which uses daily minimum and maximum temperature and precipitation as primary input. Weather-related variables (WRV's), which are functions of the primary inputs, have been defined and will be tested for their relationship to yield. Robertson's biometeorological time scale has been adjusted to winter wheat varieties and environments and will be used to define WRV's over phases of the crop calendar rather than calendar days. The WRV's are expected to measure yield-reducing effects of inadequate soil moisture, excessive precipitation, excessively high and excessively low temperature and excessive variation in winter temperatures. The data set for fitting the model will be Agricultural Experiment Station varietal trial yields and associated daily weather over the Great Plains winter wheat region. Almost all work preparatory to running regression analyses has been completed.

SUPPORTED BY Kansas State Government - Topeka

5.0021, ROCKET INVESTIGATION OF ELECTRON PRECIPITATION TRIGGERED BY VLF EMISSIONS
D.L. MATTHEWS, Univ. of Maryland, Inst. For Fluid Dyn. & Math., *College Park, Maryland* 20742 (DPP75-03516 A02)

In this NSF/NASA jointly supported project, three Nike-Tomahawk rockets will be instrumented with electron spectrometers of proven design to study the plasma physics of wave particle interactions in the earth's magnetosphere. These rockets will be launched from Siple Station, Antarctica, during austral summer of 1977/78 in conjunction with balloon, satellite, and ground-based observations of wave-particle interactions.

Logistics support at Siple Station is required for 14 people (see Operations Plan) during December and January, 1977/78.

SUPPORTED BY U.S. Natl. Science Foundation

5.0022, ELECTRON AND ION BEAM SYSTEMS
H.A. COHEN, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF249270)

AF function - communication satellites in geosynchronous orbit. Deficiency - electrical charging of satellites by ambient particles causing anomalous switching in electronic circuitry. Objective - development, testing and use of charge ejection systems to duplicate, prevent, or control satellite charging. How research contributes - by the development, testing and use on space vehicles of charge ejection systems, charging of satellite surfaces can be controlled for predetermined periods, obtaining either large or small potential differences with respect to ambient plasma.

A satellite electron beam system (SEBS) and a satellite positive ion beam system (SPIBS) are being developed, built, and tested, using a combination of contractual efforts, and in-house AFGL laboratory work. These efforts are being coordinated with those responsible for SCATHA to obtain instruments with the optimum specifications in terms of the required measurements and the satellite's physical and electrical requirements.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory LK, Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0023, OPTICAL OBSERVATIONS OF DEEP SPACE OBJECTS
S.P. WORDEN, U.S. Air Force, Geophysics Laboratory, *Bedford, Massachusetts* 01730 (DF248880)

AF function - communications, surveillance, detection, tracking. Deficiency - inability to obtain high angular resolution imaging detail through the earth's atmosphere. Objective - to develop instrumental and computational techniques to be used for recovering the highest possible angular resolution images of deep space objects when observed through the earth's atmosphere. The application of this technique to recovering the highest possible resolution images of earth orbital satellites and the determination of the limitations and requirements for reconstructing such images, particularly the determination of limiting brightness. Determination of design constraints on ground-based optical telescopes to be used for image reconstruction work. How research contributes - improves Air Force surveillance and identification capabilities on earth orbital satellites by up to a factor of fifty.

A high-quality instrument is to be constructed by the University of Arizona which will be used to obtain the short exposure (speckle interferometry) photographs which are used in image reconstruction work. This system will be designed so as to obtain the maximum possible signal-to-noise and data acquisition efficiency, since a key limitation to image reconstruction work is placed by the ability to acquire information on fainter objects such as satellite. This system will be used to acquire data from which the fundamental limitations to image reconstruction capabilities may be obtained. The specific parameters to be studied are the isoplanatic patch size, spectral bandpasses needed, exposures times and limiting magnitudes. Computer software to institute the general-purpose Knox-Thompson image reconstruction scheme will be developed. Using smaller telescopes, studies will be begun on the feasibility of using large multiple minor telescopes for image reconstruction work. Using the speckle camera which is to be built, data on satellites and resolved stellar objects will be obtained from which reconstructed high-resolution images will be produced.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH, Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0024, REMOTE SENSING WITH ELECTROMAGNETIC WAVES
J. KONG, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (ENG76-01654)

This research involves a study of remote sensing of low- conductivity areas of the Earth with electromagnetic waves. The program consists of two parts. In part one there will be an attempt to calculate the brightness temperatures of natural surfaces with theoretical models that account for absorption, layering, anisotropy, submerged scattering, nonuniform temperature distributions, and surface roughness. Active sensing with a dipole antenna deployed on the surveying area to probe the subsurface geophysical features is the major thrust of the second part of this research effort. Electromagnetic interference fringe methods including interference patterns measured both as a function of distance and as a function of frequency will be investigated for all types of dipole antennas.

SUPPORTED BY U.S. Natl. Science Foundation

5.0025, UPGRADING THE MILLSTONE HILL RADAR FOR INTERNATIONAL MAGNETOSPHERIC STUDY (IMS)
J.V. EVANS, Mass. Inst. of Technology, Lincoln Laboratory, *Lexington, Massachusetts* 02173 (ATM75-02579 A03)

This grant funds as a supplement the third installment of the upgrading of the Millstone Hill incoherent-scatter radar facility. It will allow the upgrading of the Millstone Hill incoherent-scatter facility by addition of a 150 feet Very High Frequency (VHF) dish so that it can meet the requirements of the International Magnetospheric Study (IMS). The upgrading was third of the Academy recommendations for IMS. Items one and two have already been accomplished.

SUPPORTED BY U.S. Natl. Science Foundation

5.0026, NAVY ENVIRONMENT - REMOTE SENSING OF SUBSURFACE TEMPERATURE AND SALINITY
D.A. LEONARD, Computer Genetics Corporation, *Wakefield, Massachusetts* (DN675692; N00014-76-C-1007)

The research is to investigate the feasibility of using Raman spectroscopy to obtain information on temperature and salinity in coastal waters. There, particular difficulties not encountered in the open ocean are expected because of the large magnitude of salinity and temperature gradients, heavy sediment load and high occurrence of fluorescent material.

A pulsed laser with appropriate wavelengths, mounted on a pier or a boat, will excite the water column under it; the backscattered signal will be gated to provided locality and analyzed for wavelength and polarization to obtain Raman information. Task I, funded at present, is to design the instrumentation, to document the field test plan, and to write a technical report.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

5.0027, EARLY REMOTE DETECTION OF FOMES ANNOSUS
C.E. OLSON, Univ. of Michigan, School of Natural Resources, *Ann Arbor, Michigan* 48104 (0067793; MICY00039-F)

OBJECTIVE: Evaluate capabilities of remote sensors for early detection of Fomes annosus. Identify optimum system parameters for pre- visual detection of the disease.

APPROACH: Review available imagery of NASA Test Site 190 for tonal anomalies in conifer stands and relate to vigor and disease conditions through field verification. Evaluate level-slicing with single channel and ratioed MSS data for pre-visual detection of tree-vigor decline.

PROGRESS: Analyses of field and laboratory data gathered in 1974 and early 1975 were completed and summarized in a master's thesis. Among the unanswered questions are the effect of pine canopy geometry on the spectral reflectance of that canopy and the significance of changes in canopy geometry resulting from infection by Fomes annosus and other stress vectors. Research plans leading to a better understanding, and possible answers to these questions have been formulated and initiated. This work is being carried out by a graduate student as his doctoral dissertation project.

SUPPORTED BY Michigan State Government - Lansing

5.0028, USE OF SKYLAB REMOTE SENSING DATA TO ANALYZE MICHIGAN CROP AND FOREST RESOURCES
L.V. MANDERSCHEID, Michigan State University, Agric. Experiment Station, *East Lansing, Michigan* 48823 (0064372; MICL03136)

OBJECTIVE: Determine feasibility and accuracy of crop and forest identification using SKYLAB sensors. Develop crop acreage estimation procedures using remote sensing and evaluate economic feasibility.

APPROACH: Multispectral sensor data will be computer processed to obtain rapid and automatic mapping and measurement of forest and crop types. Both SKYLAB (EREP) and aircraft data will be used and compared with photointerpretative data. Ground truth data will be used to obtain accuracy measures. Costs of alternative sampling and sensor strategies will be estimated by budget techniques and compared with current costs and accuracies.

PROGRESS: Photointerpretation showed the S-190B imagery to be adequate for fields larger than five acres. Imagery from the S-190B was superior to that of the S-190A. Crop identification and acreage measurement were difficult because of of the lack of temporal imagery. S-192 data for August 5, 1973, provided disappointing accuracy with an average absolute classification accuracy of 70 percent using 5 classes. Use of a mixtures classifier produced slightly lower accuracy. An operational system with accuracy comparable to the SKYLAB imagery and data analyzed for this study would not be economically feasible relative to current S.R.S. methods.

SUPPORTED BY Michigan State Government - Lansing

5.0029, REMOTE SENSING LABORATORY

M.P. MEYER, Univ. of Minnesota, Agric. Experiment Station, *St. Paul, Minnesota* 55101 (0065906; MIN-19-033)

OBJECTIVE: Reduce the time and costs necessary with current ground methods to monitor features essential to research and to practical resource management.

APPROACH: As the time of an overflight request for remote sensing project support, the needs will be determined in cooperation with the project leader and the flight plan developed. Following overflight, the film will be catalogued, interpretation pian set up and the data gathered and analyzed.

PROGRESS: A 35mm aerial photography system previously developed for rangeland analysis in Montana was tested for use in Minnesota. Sequential vari-scale 35mm vertical color and CIR photography of 2 of the Nature Conservancy's many native prairie reserves was flown May- October. Disturbances and invading exotic grass species were most easily recognized on the CIR in the spring coverages at scales smaller than 1:18,000. October CIR was best for identification of individual native grass species at scales as small as 1:18,000. A total of 38 water body sample locations on Isle Royale National Park were photographed with a 70mm multispectral camera system (color, CIR, water- penetrating films) at a scale of 1:6,000 to determine the location, type and amount of emergent vegetation available to the moose population on the island.

SUPPORTED BY Minnesota State Government - St. Paul

5.0030, DEVELOPMENT OF AUTOMATED PROCEDURES FOR CHANGE DETECTION AND LAND USE MAPPING FROM SATELLITE DATA

H. STRUVE, U.S. Army, Waterways Experiment Station, *Vicksburg, Mississippi* 39180 (DA0W8184)

To develop and demonstrate automated procedures for obtaining land use classifications from satellite data that are acceptable for use by the Corps divisions and districts in detecting land use changes and producing land use maps.

Computer procedures will be developed that will automatically and/or interactively (1) locate and extract spectral data from satellite mangetic data tapes for specified geographic regions and sort the data into unique signatures on the basis of radiance values recorded for each PIXEL for four spectral bands, (2) remove instrument noise and correct radiance values for the effects of terrain slopes, shadows, and atmospheric conditions, (3) rectify positions of satellite PIXEL elements to the UTM coordinate system of topographic base maps, (4) classify the sorted radiance values on the basis of spectral signatures for land use types verified at specific locations, and (5) compare radiance values from two satellite flyovers and portray changes in land use on a map overlay. The accuracy of land use mapping procedures will be demonstrated for selected areas in four Corps of Engineers districts, namely, New Orleans, Mobile, Huntington, and Omaha.

ADDENDA: Supporting agency address is: OCE Waterways Experiment Station, PO Box 631, Vicksburg MS 39180

SUPPORTED BY U.S. Dept. of Defense - Army

5.0031, REMOTE SENSING APPLICATIONS TO LAND USE AND NATURAL RESOURCES IN NEW HAMPSHIRE

P.E. BRUNS, Univ. of New Hampshire, Inst. of Nat. & Environ. Rsou., *Durham, New Hampshire* 03824 (0067211; NH00232-S)

OBJECTIVE: Develop a master set of stereograms of forest stands and other natural resource features for the 1974 flight of southern New Hampshire, and other readily available imagery that would act as keys for photointerpreters. Develop aerial volume tables in cubic feet for softwood, hardwood and mixed stands with application to timber stands, both local and in northern New England generally. Develop methodology for extracting information on long-term forest land use trends for planning purposes based on successive flights (over time) of aerial photography.

APPROACH: Application of aerial photography to recognition and classification of a variety of forest stands and other land features such as agricultural, cultural, forest, geologic and soils; application of aerial photographic measurement to the evaluation of commercial forest stands as to wood volume, diameter class and stand height; test and further develop classification systems for use on successive flights to determine quantitative data on the extent of changes in forest cover and land use.

PROGRESS: A land use classification with 13 categories was developed for use with medium-scale aerial photography. Using Dover, N.H., a 17,800 acre town area, as a test site, major changes in land use in the 1953-1974 period were determined. Declines in acreage use were in agricultural (less than 29%) and open (less than 23%), whereas gains took place in residential (more than 52%), commercial, industrial, mining (sand and gravel) and public service. Forest land declined only 4% in area, indicating that development pressures here were not primarily on this category of land. Under a cooperative agreement with the Dartmouth Remote Sensing Group, programs and facilities of the Goddard Institute for Space Studies in New York were available to develop signatures using Dover training sites for broad forest types and other land classifications expressed on magnetic tape data from the satellite pass (LANDSAT 1) of July 24, 1973. These are listed in a progress report to cooperators dated October 1, 1975; the significance is in the possibility of combining conventional aerial photography with satellite data for use classification in New Hampshire (Dover will be used as a test site for the comparison of methodology).

SUPPORTED BY New Hampshire State Government - Concord

5.0032, AGRICULTURAL LAND IN NEW HAMPSHIRE

D.M. PESCHEL, Univ. of New Hampshire, Agric. Experiment Station, *Durham, New Hampshire* 03824 (0070370; NH00236-S)

OBJECTIVE: Determine the amount and location of land with potential for agricultural use in New Hampshire. Determine changes in use of agricultural land from 1950 to 1970. Determine current pressures on agricultural land.

APPROACH: Potential agricultural land will be identified on soil survey maps and classified according to potential. Aerial photos will be used to determine how much potential land is currently available for agricultural use. Interviews with town and county officials will be used to determine significant pressures for alternative employment of agricultural land.

SUPPORTED BY New Hampshire State Government - Concord

5.0033, TIME-INTERVAL MULTIBAND REMOTE SENSING FOR ANALYZING URBAN FORESTED AREAS

J.O. LAMMI, Univ. of North Carolina, Agric. Experiment Station, *Raleigh, North Carolina* 27600 (0063163; NC04042)

OBJECTIVE: Determine use of 18-day interval ERTS-1 satellite imagery in forest green space analysis, evaluate improvements in green space monitoring through ERTS-B and SKYLAB, demonstrate utility of multiband camera for ground truth acquisi-

tion, and show resource management application of multispectral color-additive viewer.

APPROACH: At least two test sites will be selected, satellite imagery will be studied, ground truth will be determined from multiband camera and field work, results will be transmitted to resource managers.

PROGRESS: Remote sensing techniques utilized included imagery from LANDSAT I (formerly called 'ERTS-I') and photography from conventional aircraft altitudes, high altitude (U-2 aircraft at 65,000 ft), & SKYLAB (269 miles). In addition to commonly available optical equipment, the multispectral color additive viewer (SDC 66) was utilized in analysis of LANDSAT I & SKYLAB materials. Air photography at various altitudes can provide much information useful to urban forestry planning and management. Also useful is color infrared photography from 65,000 feet. LANDSAT imagery from approximately 569 miles was more difficult to use for urban forestry purposes. It was possible to identify forest areas down to about five acres in size, to delineate the boundaries of urban areas, shopping centers, transportation routes, industrial-commercial zones, etc. In urban forested areas the Landsat I imagery aggregated individual trees with groups of trees to provide a more striking view of forest cover than could be prepared from air photography. SKYLAB photography was much superior to LANDSAT I in resolution. The best SKYLAB photography was found to be a color transparency magnified to a scale of 1:64,000 from the NASA photo received at a scale of 1:475,000. The forestry detail included a clear picture of density, individual dwellings and the tree cover around them, and a great amount of detail on various kinds of developments where tree cover had been disturbed or removed.

SUPPORTED BY U.S. Dept. of Agriculture - C.S.R.S.

5.0034, DETECTION OF INCIPIENT SALINE SEEPS

L.J. BRUN, North Dakota State University, Agric. Experiment Station, *Fargo, North Dakota* 58103 (0067939; ND04526)

OBJECTIVE: Photographic and thermal imagery will be used to locate existing and potential saline seeps and to monitor changes in saline seep acreage.

APPROACH: Two areas affected by saline seeps will be overflown twice in 1975 and once in 1976 to obtain photographic and thermal imagery. Ground truth surveys will be conducted to delineate saline- seep areas. Survey description will include date, location, land use, soil type, vegetation, presence of salt crusts, electrical conductivity of soil-water extract, earth resistivity measurements and possible interferring imagery. Remote sensing imagery will be correlated with ground truth data.

PROGRESS: A 22 square mile study area near Dickinson, N.D., and a 6 square mile study area near Mott, N.D., have been selected. Within each study area, saline seeps were located, numbered and delineated with the aid of aerial photographs. The Dickinson study area had 102 saline seeps and the Mott study area had 35 saline seeps. Each saline seep was then investigated; factors noted include location, land use, slope, aspect, class (midslope, basin, drainageway), type (potential, active with vegetation, bare surface, salt crust), vegetation, interferences (areas that might look like saline seeps from the air) and earth resistivity to quantify salinity at each seep. A soils legend for soils located in the saline seep areas has been completed. A multispectral scanning and thermal imagery flight was made in September 1975.

SUPPORTED BY North Dakota State Government - Bismarck

5.0035, DISTRIBUTION AND IMPACT OF THE BALSAM WOOLLY APHID IN THE GREAT SMOKY MOUNTAINS NATIONAL PARK

R.L. HAY, Univ. of Tennessee, Agric. Experiment Station, *Knoxville, Tennessee* 37916 (0070661; TEN00081)

OBJECTIVE: Determine locations and severities of balsam woolly aphid infestations on Fraser fir. Determine host community age, species, and stand structure preferences of the aphid. Provide permanent reference for future analysis of the management problem.

APPROACH: Color infrared aerial transparencies will be used to locate aphid infestations. Species and stand structure, level of infestation, bark characteristics, growth rates, stages of mortality, slope, aspect, elevation, and site quality will be quantified.

PROGRESS:

SUPPORTED BY Tennessee State Government - Nashville

5.0036, COMPUTER MODEL OF PLASMA FLOW NEAR THE EARTH'S PLASMAPAUSE

R.A. WOLF, Rice University, Graduate School, *Houston, Texas* 77001 (DF248280; F19628-77-C-0012)

AF function - communications, navigation, ionosphere and magnetosphere modelling. Deficiency - inadequate knowledge of how convective processes in magnetosphere perturb ionospheric structure characteristics which in turn affect AF communication systems design. Objective - develop computer models for time-dependent convective flow. Analyze and synthesize AF satellite data. How research contributes - provides data essential to radar propagation, provides data essential for design and utilization of communication, guidance and surveillance systems, provides understanding of dynamical ionospheric/magnetospheric processes.

Construct computer models for time-dependent convection in the ionosphere and magnetosphere at auroral and middle latitudes using electric fields and plasmas observed by AF satellites as realistic boundary conditions.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH, Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0037, EFFECTS OF LONG-TERM GREAT LAKES WATER LEVEL CHANGES

C.J. GALVIN, U.S. Army, Coastal Engin. Res. Center, *Fort Belvoir, Virginia* 22060 (31195)

OBJECTIVE: To provide guidance for the Corps and the public on the effects, potential damage, and protective action required prior to the next cycle of high water on the Great Lakes.

APPROACH: Between 1970 and 1974, 17 profiles along Eastern Lake Michigan have been surveyed every four weeks. These data along with environmental variables will be examined and reported on. In addition, a series of monthly aerial photographs of 12 miles of Lake Michigan shoreline around the Cook Nuclear Power Plant, taken during the same period of time, will also be studied. These photographs are available from NCD.

SUMMARY: Improved estimates of bluff erosion as a function of water level, bluff composition, time and location will result.

These results will be available by end of FY 77 as CERC publications and will be used to better plan for effects of next rise in water level in Great Lakes and to estimate effects of water level regulation on Great Lakes.

NCD has specified a need to be able to predict the effects of water level change on bluff erosion in the Great Lakes and these results will help satisfy that need.

SUPPORTED BY U.S. Dept. of Defense - Army

5.0038, NASA MAPPING

L.C. ROWAN, U.S. Dept. of the Interior, Geological Survey, *Herndon, Virginia* 22092 (9790-01662)

STATES TO WHICH PROJECT PERTAINS: Nevada and Utah.

The main objective of the experiment is to apply the multispectral analysis techniques developed during ERTS-1 experiment 9648 to mineral resources assessment of a large region which has significant economic potential. Additional objectives include comparison of the multispectral techniques using MSS data to conventional geologic methods of mineral resources evaluation and refinement of the visible and near- infrared spectral reflectance model developed in the ERTS-1 south- central Nevada test site.

The following specific objectives are planned in an effort to refine this model and to bring these techniques to a fully operational status: (1) carefully coordinated program of mineralogical and visible and near-infrared spectral reflectance analyses; (2) refinement of detection and classification techniques based on

the ERTS-1 experience in south-central Nevada; (3) study of the effects of vegetation cover, atmospheric scattering and absorption, scale, chemical weathering, and host rock alteration-metallization relations; (4) further development of less expensive computer image enhancement and classification techniques useful in mineral exploration; and (5) development of methods for integrating these results with those of geological, geochemical, and geophysical investigations.

SUPPORTED BY U.S. Dept. of Interior - Geological Survey

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, ANALYSIS OF AIRCREW PERFORMANCE DURING OPERATIONAL AND SIMULATED ROTARY WING FLIGHT

K.A. KIMBALL, U.S. Army, Aviation Psychology Division, *Ozark, Alabama* 36360 (DA0B6890)

To provide Army aviation with the more timely analysis and interpretation of research data on aircrew performance during rotary wing flight, while providing for more efficient processing of these data, thus permitting greater research productivity.

The approach will involve the expansion of the SEL 8500 hybrid computing system to allow simultaneous real-time processing of operational and simulator flight data. This effort will entail acquisition of required core storage, accomplishing hardware interface and providing the necessary software to allow the time sharing task. The successful accomplishment of this effort will permit the immediate accessibility of real-time data acquisition and analysis functions critical to flight research while allowing other in-house research efforts to proceed without undue delays due to computer inaccessibility.

ADDENDA: Supporting agency address is: MDRDC Aeromedical Research Laboratory, Ft. Rucker AL 36362

SUPPORTED BY U.S. Dept. of Defense - Army

6.0002, EVALUATION OF SCAN CONVERTERS FOR AIRBORNE APPLICATION

K.A. KIMBALL, U.S. Army, Aviation Psychology Division, *Ozark, Alabama* 36360 (DA0B6901)

To evaluate the potential of imagery scan converter processing techniques for application to a target acquisition task.

The approach will be to integrate the necessary visual and electrical components to provide low-cost target acquisition prototype device and determine the feasibility of this type of device for field application.

ADDENDA: Supporting agency address is: MDRDC Aeromedical Research Lab., Ft. Rucker AL 36362

SUPPORTED BY U.S. Dept. of Defense - Army

6.0003, UPT DATA BASE

M. NATAUPSKY, U.S. Air Force, Human Resources Laboratory, *Chandler, Arizona* 85224 (DF223250)

To identify long-term effects of diverse variables on flying performance, to determine the relationship between daily grades and check grades, and to evaluate practice requirements and student progress rates (i.e., readiness to learn) during various phases of UPT by studying UPT grades and other appropriate measures. The primary objective is the establishment of a single UPT data base. The secondary objective is the conduct of statistical investigations on the data base.

The daily flying grades will be obtained from Air Training Command. This data will be formatted for analysis by AFHRL/FT. As a minimum, the data will also include syllabus flight number, maneuver identification, and IP grades. A series of statistical analyses will be performed on the data.

ADDENDA: Supporting agency address is: AF Human Resources Laboratory FTS, Williams AFB, Arizona 85224

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0004, INCIDENCE AND COSTS OF AIR SICKNESS IN NAVAL AVIATION

F.E. GUEDRY, U.S. Navy, Perceptual & Behav. Sci. Div., *Pensacola, Florida* 32508 (DN777278)

The immediate aim of this project is to document the incidence and cost of the air-sickness problem in naval aviation. A recent pilot study of NFO trainees suggests that air sickness accounts for a larger proportion of student attritions than has been suspected heretofore. Related evidence indicates significant additional costs from repeated hops, extensive medical and psychological evaluation, treatment programs, etc, all resulting in increased time to train. It is expected that availability of incidence and cost data will permit the judicious selection of remedial options appropriate to the achieved level of training.

Initial priority will be placed on conducting a longitudinal study of air sickness in NFO trainees as they pass from VT-10 basic training through VT-86 advanced training to selected assignments in replacement air groups. Air-sickness incidence and severity data along with performance degradation measures will be obtained from each student and each instructor for each training hop over the entire training period. To establish a firm statistical background, it is planned to follow 10- 12 consecutive NFO classes so as to achieve a minimum of 200 students and 8,000 hops. Air sickness incidence will be related to particular hops, individual order of hops received, delays in training, seasonal variations in turbulence, and overall student performance. Other data to be collected include case-by-case reasons for attrition, costs of attrition, costs for repeated hops, adaptation histories of air-sick individuals, and relationship between degree of air sickness and performance degradation and/or attrition.

ADDENDA: Supporting agency address is: Naval Aerospace Medical Research Lab., Pensacola, FL 32508

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0005, PREDICTION OF AIR-SICKNESS SUSCEPTIBILITY IN NAVY FLIGHT STUDENTS

F.E. GUEDRY, U.S. Navy, Perceptual & Behav. Sci. Div., *Pensacola, Florida* 32508 (DN777378)

The objective is to develop procedures that will improve prediction of air-sickness susceptibility. Potential benefits of this project are improvement of selection and placement methods and early detection of individuals who would benefit from therapeutic and preventive options.

Tests involving measurement of several immediate perceptual reactions and adaptive changes in reactions will be developed. Criteria of procedure selection will include feasibility for rapid administration as well as theoretical and empirical indications of validity. Concomitant measures in physiological indices will be taken on some tests. Intercorrelations among tests, including a motion-sickness questionnaire, structured for use with entering flight students, will be determined to investigate the hypothesis that there are idiosyncratic tendencies in immediate and adaptive perceptual reactions that are related to motion-sickness susceptibility. Tests administered to air- sickness referrals and suitable controls will provide retrospective validity estimates. Time permitting, prospective validity estimates from coordination with a new project on incidence and costs of air-sickness will be obtained.

ADDENDA: Supporting agency address is: Naval Aerospace Medical Research Laboratory, Pensacola, FL 32508

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0006, DETERMINATION & IDENTIFICATION OF HUMAN BRAIN WAVE PATTERNS ASSOCIATED WITH COGNITIVE & PERFORMANCE EVENTS IN OPERATIONAL SETTINGS

E. DONCHIN, Univ. of Illinois, School of Liberal Arts & Sci., *Urbana, Illinois* 61801 (DN675068; N00014-76-C-0002)

The overall objective is to attempt to determine and identify human brain wave patterns associated with (1) particular stimuli; (2) cognitive events in a learning situation; (3) performance events in a simulated aircraft cockpit. Such information could provide a basis for improving human performance in decision making and man-machine communication.

Work during the first year will include further development of an event-related potential (ERP) vocabulary, i.e., the analysis of cortical potentials into specific components as they relate to cognitive events. At the same time equipment and procedures will be introduced in the computer-assisted instruction laboratory and the human performance laboratory and experiments will be started to test the efficacy of ERP in enhancing performance in the instructional and cockpit environment.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0007, INVESTIGATION OF RELATIONSHIPS BETWEEN CREW RESTRAINT DESIGN CRITERIA AND IMPACT INJURIES

C.F. ACEVEDO, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF322360)

USAF accident investigations reveal that major injuries and fatalities may be related to the ineffectiveness of the personnel restraint systems under emergency escape or aircraft crash conditions. For example, operational statistics and aeromedical analysis have shown that the high spinal fracture rate (42 percent) occurring during use of the F-111 crew escape module is probably related to the geometry of the restraint system and ballistic inertia reel. Although design criteria are available they are often disregarded since their relationships to crew injuries are seldom quantified. The objective of this research effort is to determine the injury pathology associated with a specific impact protection system's design criteria. These criteria pertain to restraint system geometry, restraint tie-down points, webbing materials properties, load distribution and integral impact attenuation.

The injury potential associated with specific restraint systems will be experimentally evaluated using a subhuman primate. A baseline for comparative evaluation of protection systems will be established by conducting impact tests using the standard USAF lap belt and shoulder harness geometry published in current design specification handbooks. Impact injury pathology will be assessed using the AMA Abbreviated Injury Severity Index. Other restraint systems that are operational or in the conceptual design phase will be similarly tested to identify unique injury modes and to compare the severity of the observed injuries with those of the baseline protection configuration. Data collected under this work unit will also be used to provide methods for predicting impact injury severity using mathematical models.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch. Lab. BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0008, CONDUCT AIR AND GROUND CREW NOISE STUDIES TO EXPAND/UPDATE USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK

H.K. HILLE, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321420)

USAF aircraft and equipment operations generally produce adverse noise levels at flight crew, passenger, and ground crew locations which must be evaluated with respect to hearing risk, ear protection requirements, voice communication capabilities, facility siting problems, etc. The objective of this work unit is to expand and update the USAF Bioenvironmental Noise Data Handbook (developed under work unit 72310418) and, thereby, provide the data necessary to define these physical noise environments for use by MAJCOM/airbase bioenvironmental engineers, flight/ground safety officers, and others concerned about personnel safety and effectiveness.

The technical approach is to conduct field measurements, perform spectral analyses, and then apply Noisebank, the most advanced omega software, and AFR 161-35 exposure limits to compute the required physical and psychoacoustic measures.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch. Lab. BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0009, DETERMINATION OF G-CUE ENVIRONMENTS

J. LOCH, U.S. Air Force, Human Resources Laboratory, *Dayton, Ohio* 45433 (DF228230)

To determine the pilots' g-cue environment of various respresentative aircraft under typical maneuvers. The results will be applicable to the development of future motion and force systems including the advanced low-cost g-cuing system. The end product of this work is a data base of representative aircraft g-cue environment profiles. No technical report will be published.

The approach is to collect data through use of the computer flight models for the various aircraft under typical maneuvers. Flight models of representative aircraft will be used such as F-15/16 (fighters), C- 130 (cargo), and AMST (transport). The output accelerations will then be transferred from the aircraft center of gravity (c.g. point) to the pilot seat using the aircraft angular velocity, acceleration, and position vector to the seat location. A compilation and evaluation of the data will be performed to determine the g-cuing simulation needs for such aircraft types under typical maneuvers and to gain a better understanding of their motion and force simulation requirements. The LAMARS facility at the AFFDL will be used to obtain much of data desired on the effort. This information will be obtained by 'piggy-backing' the study with planned aircraft handling qualities studies. The LAMARS cockpit will not be used in this study. Only the LAMARS computational system will be required.

ADDENDA: Supporting agency address is: AF Human Resources Laboratory ASM, Wright-Patterson AFB, ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0010, BIOASSAY IN SOIL MICROORGANISMS

S.A. LONDON, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF320500)

To utilize microbial systems for evaluating the potential environmental impact of various materials used in Air Force operations, such as missile propellants, aircraft fuels and lubricants and other substances used in consequential amounts that could have acute and/or chronic environmental effects. The data derived from this effort are considered in conjunction with similar results obtained with other biological indicator and test systems to form a data base upon which scientifically valid environmental impact assessments and statements can be prepared.

Microbial cultures isolated from soil samples will be investigated concerning their responses to both acute and chronic exposure to potential environmental pollutants. Selection of species will be based upon: (1) applicability of physiological requirements to experimental procedures, (2) relationship of responses to pollutant exposure with ecosystem impact. Microbes will be studied under both closed (batch) system and open (steady-state growth) system conditions to ascertain acute and chronic effects. Responses to be evaluated will include growth kinetics, bacteriocidal/bacteriostatic effect, physiological changes, genetic (mutation) effects, pollutant degradation or accumulation. This effort will establish no-effect levels for single and multiple cultures and will serve as both a laboratory test system and a means of predicting potential environmental consequences of inadvertant intrusion in soil and water of Air Force materials.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch. Lab. TH, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0011, COMPUTER-AIDED HUMAN ENGINEERING DESIGN

J.W. MCDANIEL, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF320930)

The objective of this work unit is to develop a computerized technique which will accomplish major elements of the design of man- machine crew stations. The products will be detailed, integrated design requirements to be utilized by those activities that procure crew stations and the capability to provide either crew-station design alternative or evaluation of existing designs. The work unit will also provide realistic modeling techniques for evaluating man's performance capabilities in hazardous environments in order to reduce the risks associated with experimenting with human subjects. This effort is coordinated with cognizant U.S. Navy and NASA personnel in regard to both overall objectives and technical approaches.

Computer-aided design and evaluation techniques will be developed which translate the human engineering data statistical bases into functional standards for crew-station design and evaluation. Computerized interactive graphics techniques will be employed to minimize the time required to (1) design crew stations and (2) analyze that or other designs. The computerized biomechanical man-model (COMBIMAN) program will display to the user a man-model of variable proportion capable of simulating the physical characteristics of crew members in a true 3-d crew station. During FY 77, the COMBIMAN link and enfleshment equations will be validated against actual subject data including clothing and protective equipment variables. By the end of 1978, the model will be able to simulate the characteristics of AF women in the workplace. The Human Engineering Computer-aided Design (HECAD) Program will allow the user to perform complex task analyses on candidate control/display configurations. The times required to rea h, operate, and attend to various types of controls/displays can be rapidly determined on an interactive graphic-type display. During 1977, human performance data on operation of standard cockpit components will be incorporated in HECAD.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch. Lab. HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0012, VOICE COMMAND SWITCHING

D.F. MCKECHNIE, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321160)

Human factors research has been involved with the efficient use of man's visual, auditory, and coordinated motor skill in crew stations. Increases in demands upon the eye/hand workload in crew stations leads to investigation of other means to carry out that function. A potential method for accomplishing the functions heretofore defined as eye/hand, is the use of voice actuated switching or input coupled with voice feedback for verification. Development of voice or speech recognizers and synthesizers now permits them to be considered for switching systems. The use of the voice recognition and synthesis systems to control the B-52 EWO electronically steerable antenna system (ESAS) after failure of its automatic driving capability will be investigated. Successful application of these voice systems may directly enhance mission success.

An interface of the ESAS drive system will be accomplished in the EW simulator. Mission requirements, tasks, and scenario will be developed to allow the EWO to maintain antenna tracking through verbal commands while accomplishing his other EWO tasks. Comparison of the operator's accuracy and time to perform these duties with and without the voice command system will be evaluated. Acquisition of the voice synthesizer, interfacing of the recognizer after ESAS installation, vocabulary selection and command structure all impact scheduling. All but the actual tie to the SW simulator can be initiated immediately. January 1977 is the projected date for system checkout and scheduling.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch. Lab. HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0013, EVALUATION OF INTELLIGIBILITY OF TALKING PERIPHERAL COMPUTER

T.J. MOORE, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321500)

This work unit has as its objective the evaluation of the intelligibility of a synthetic voice output from a computer. A computer peripheral with voice output will have a number of applications in logistic areas, as well as providing a direct voice link from radar-computer to pilot.

This work unit encompasses the in-house work that accompanies the contractual effort which will produce a computer peripheral with voice output (72330331). It includes the revision of existing software algorithms for speech synthesis to improve intelligibility and operating speed. It also includes the running of intelligibility tests (with listener panels) to measure the acceptability of both the software and hardware versions of the voice synthesizer.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch. Lab. BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0014, SCREENING TECHNIQUES

R.D. ODONNELL, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321080)

To develop a graded screening procedure for potential visual countermeasures which will allow increasingly more refined decisions concerning the effectiveness of the countermeasure against anticipated threats. The enormous costs of high fidelity and field simulation requires that only proposed countermeasures with a high probability of success be tested in these modes. The ultimate purpose is to add a low- cost series of screening procedures to a systematic evaluation sequence in order to allow larger numbers of countermeasures ideas to be tested, and to cost-effectively evaluate those with the highest probability of success. Supports AFSC development goals SO-5, TC-5, and TC-8.

Traditional and novel measurement techniques will be explored for potential utility in evaluation of countermeasures concepts. Such techniques include classical psychophysical measures, standard laboratory performance metrics, as well as standard and novel psychophysiological evaluations (e.g., visually evoked responses, eye movement analysis, etc.). In addition, a generalized tracking task containing the highest level of fidelity consistent with a broad range of operator input requirements will be developed under a separate work unit. This tracking task; and other promising measurement techniques developed in the laboratory will be validated against high-fidelity simulation and field tests, and will be sufficiently standardized to become part of assessment battery for potential countermeasures concepts. Integration of these screening procedures with higher fidelity evaluations will provide a systematized process which will allow maximally cost- effective decisions concerning the development of each countermeasure.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch. Lab. HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0015, SPECIALIZED ELECTRONIC INSTRUMENTATION FOR MANNED SIMULATION

D.A. RATION, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF322470)

Highly specialized prototype electronic devices are needed for TPO 7 human performance research. The production of these highly specialized one-of-a-kind items within an in-house work unit has many benefits to the Air Force including reduction of manhours and material costs, time savings, enhanced coordination with users, and minimum administrative efforts. The items to be produced will be determined by the needs of the research teams. The first item under this new work unit will be the development of specialized electronic circuits for use in a radar simulator display.

Prototype electronic devices will be designed, fabricated, and bench tested in support of Division research projects.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch. Lab. EM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0016, HUMAN OPERATOR TECHNOLOGY

D.W. REPPERGER, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321670)

Develop analysis, evaluation, and synthesis techniques for weapon systems which include human operators as a major subsystem and validate the procedures on example weapon systems. This will enable information about the human operator to be incorporated into weapon system performance calculations.

The approach will be to select a sample manned system, devise the relevant human operator model considering the constraints on human performance and the effects of environmental stress, and conduct either a covariance analysis or a Monte Carlo simulation to evaluate the performance of the entire weapon system.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch. Lab. EM, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0017, MILITARY SPECIFICATIONS AND STANDARDS
J.M. RING, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF320990)

There are two objectives: (1) to provide human engineering application, support and consultation at any and all stages of development--initial conception, concept evaluation, conceptual design, formulation, acquisition, testing, trouble shooting, and maintenance of systems and subsystems, and (2) to collect human factors research data and convert it into forms such as specifications, standards and handbooks that are directly usable by weapons system management and design personnel.

A diversified group of human factors specialists is maintained to respond to requests for assistance from AF, other government organizations, industry, and allied forces. The group assists in formulating the problem and makes recommendations for equipment design and for airborne and laboratory procedures, tests and evaluations, literature searches, data collection, and in-house and contract research programs. As requests for this HE expertise are received, the effort is recorded under this work unit until such time as the effort is sufficiently large to require its own documentation. This work unit provides human engineering participation to the (1) AFSC Human Engineering Panel, (2) Revision of Human Engineering Specifications and Standards, MIL-H-46855 and MIL-STD-1472, respectively, (3) Revision of DHL-3, Human Factors Engineering, and (4) Aircrew Station Standardization Panel. The results of the above efforts are utilized throughout the Air Force in the development of Air Force systems and equipment by incorporating them in contractual documents. In addition, MIL-H- 46855 and MIL-STD-1472 are coordinated and used by all three services.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch. Lab. HE, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0018, SUBJECTIVE EFFECTS IN MOIFE
R.W. SHOENBERGER, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321240}

To investigate the subjective effects of whole-body vibration in the pitch, roll, and yaw axes and in multiaxis environments. Subjective response data are available for the three translational axes (x, y and z) and this effort will extend that knowledge to rotational vibrations and to environments with simultaneous oscillations in (or around) more than one axis. The information obtained will result in improved and expanded vibration criteria for evaluating aircrew exposure to operational multiaxis oscillating inertial force environments, and provide data for improved crew station design to alleviate adverse vibration effects.

Psychophysical measurement techniques (e.g., psychophysical matching and magnitude estimation) will be used to evaluate the severity of vibration inputs. Subjects will be exposed to single-axis angular vibrations (pitch, roll and yaw) as well as combined multiaxis inputs in both translational and angular modes. Subjective intensity comparisons will be made using single-axis translational vibrations (for which there are existing criteria) as comparison standards. Data analysis will provide assessment of the subjective effects of angular vibrations in relation to translational motion and techniques for evaluating the subjective intensity of multiaxis vibrations.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch. Lab. BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0019, EVALUATION OF HEARING PROTECTORS USING ANSI REAT METHOD
M.R. STEPHENSON, U.S. Air Force, Aerospace Medical Res. Lab., *Dayton, Ohio* 45433 (DF321330)

AMRL/BBA is responsible for evaluating personal hearing protectors for use in AF hazardous noise environments. The objective of this effort is to maintain our on-going program of investigating hearing protection performance of helmets, head- sets and other sound protective devices. Hearing protectors submitted for evaluation will be measured for compliance with criteria established for acceptance on the Air Force qualified products list RE MIL SPEC 38268b and considered for potential widespread or special-purpose use in AF noise environs.

Human subjects will be employed in the laboratory evaluation of a hearing protector's sound attenuation characteristics as measured by the American National Standard Institute (ANSI) real ear attenuation at threshold (REAT) method. Results of these evaluations will be used to formulate recommendations to the c.ffice of the AF Surgeon General concerning potential application for AF use. Data will be processed and prepared in formats consistent with general methods used by the scientific community as well as the AF for estimation of noise reduction in operational situations. This effort assures that our data base is current by evaluation of the many modified and new devices appearing on the commercial market in increasing numbers.

ADDENDA: Supporting agency address is: 6570 Aerospace Medical Rsch. Lab. BB, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0020, CUMULATIVE PATHOPHYSIOLOGIC LIMITS TO REPEATED EXPOSURE OF HIGH G
J.W. BURNS, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322580)

It has been demonstrated that exposure of experimental animals to operational levels of high sustained acceleration can produce myocardial pathology. The degree of pathologic injury can be determined through available histologic techniques. However, it is also very important to extensively investigate the relationship between the observed pathology and functional changes that may occur in the cardiovascular system. It is the objective of this effort to determine if there is a pathophysiologic relationship resulting from high sustained repetitive and cumulative acceleration, and if so, to define physiologic endpoints which should not be exceeded.

Miniature swine and subhuman primates will be used for the majority of these studies. Uninstrumented as well as chronically instrumented animals will be subjected to operational acceleration levels over varying periods of time to define the cumulative pathophysiology of acceleration stress. In this manner a data base will be developed which will be continuously updated with pathophysiologic information from both species as the cumulative exposure time increases. The USAFSAM centrifuge will be used to expose the experimental subjects to the various g stresses.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0021, DESIGN AND QUALITY CONTROL CRITERIA FOR UPGRADED MULTILAYER WINDSCREENS
C.P. HATSELL, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322650)

Specify optical design and quality-control criteria for multilayer aircraft windscreens to optimize system safety and effectiveness.

Apply techniques of geometrical optics and optical physics to develop methods of and devices for quantifying windscreen distortion, and relate these distortion measures to windscreen geometry and materials. Determine the feasibility amd materials specifications for antireflectant coatings to reduce multiple imaging phenomena in thick windscreens of complex geometry. These measures and specifications will direct materials and manufacturing technology toward windscreen improvement for enhanced operational capability.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0022, MANNED PERFORMANCE LIMITS FOR COCKPIT THERMAL LOADING
L.G. MYHRE, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322210)

The goal of this effort is to identify the upper thermal limits of the cockpit thermal environment which are consistent with high-level crew performance.

Previous work in this area documented under work unit 7164-17-24 has shown a relationship between elevated environ-

mental temperature and impaired crew performance as measured by a tracking task. Baseline data obtained from non-heat acclimated men exposed to selected thermal stresses will be compared with the performance of men exposed to the same conditions after becoming acclimated to work in the heat.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine VN, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

6.0023, SUPPORT TO OTHER DOD & US GOVERNMENT AGENCIES AND CIVILIAN ORGANIZATIONS
D.H. SPOOR, U.S. Air Force, School of Aerospace Med., *San Antonio, Texas* 78235 (DF322010)

The objective of this work unit is to provide direct support to requestors for assistance through utilization of the existing aerospace medicine technology data base, the expertise of the Clinical Sciences Division staff, and where required, the expertise of USAFSAM resources outside of Clinical Sciences Division.

The approach to be utilized will involve initial Division staffing of the specific request to determine the full spectrum and scope of the endeavor, the individuals to participate in the evaluation, and the assignment of OPR to a specific Clinical Sciences Division scientist. All available Division resources will be subject to utilization at one time or another including the various medical information files, the accumulated patient evaluation records from the Aeromedical Consultation Service, and also the accumulated years of aeromedical experience and judgment. Anticipated products will be summary of evaluations and analyses which may be in a simple letter reply, a USAFSAM technical report, or published paper. This is a new work unit for FY 77.

ADDENDA: Supporting agency address is: USAF School of Aerospace Medicine NG, Brooks AFB, Texas 78235

SUPPORTED BY U.S. Dept. of Defense - Air Force

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, ALGEBRAIC FOUNDATIONS OF STABILITY THEORY
M. MARCUS, Univ. of California, School of Letters & Science, *Santa Barbara, California* 93106 (DF046720; AF-AFOSR-3166-77)

AF function - the design of stable control systems is essential in the development of effective aerospace vehicles. Deficiency - the stability of nonlinear control systems cannot be analyzed by standard techniques. No effective techniques are useful in the study of control systems of interest to the Air Force. Objective - this research intends to study the stability theory for systems of ordinary differential equations that describe any dynamical system. It will be concerned with eigenvalue localization theorems for finite matrices. How work contributes - schemes for determining the stability properties of control systems will be developed.

This research will cover these specific topics: (1) an investigation of the geometric structure of the numerical range of a transformation--this set is always an inclusion region for the eigenvalues, (2) the construction of easily computable estimates for the eigenvalues of sums and product of finite matrices in terms of the eigenvalues and entries of the summands or factors, (3) localization of eigenvalues under conditions of special constraints on the matrices or their spectra, (4) bounds for computable matrix functions in terms of eigenvalues and other invariants, (5) investigation of unresolved questions in linear algebra involving matrix eigenvalues and diagonal elements, and eigenvalues of matrix sums, (6) localization of eigenvalues of matrices of special type, (7) computational techniques for the permanents of m x n matrices, and (8) development of computerized retrieval system for research publications in linear algebra.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NM, Bldg. 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

7.0002, INITIAL RCSDF DESIGN STUDY
D. ANDERSON, Sperry Rand Corporation, *St. Paul, Minnesota* 55165 (DF728310; F30602-76-C-0355)

The objective of this study effort is the specification of a comprehensive development plan for the RADC Reconfigurable Computer System Design Facility (RCSDF).

RCSDF technical requirements shall be determined by analyzing desired RCSDF operating capabilities. The RCSDF development plan will then be designed by comparing RCSDF technical requirements with the present state-of-the-art in multiprocessor computing systems.

ADDENDA: Supporting agency address is: Rome Air Development Center ISC, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

7.0003, FINITE-ELEMENT EDIT AND DISPLAY PROGRAM
E. EDWARDS, Battelle Memorial Institute, *Columbus, Ohio* 43201 (DF135550; F33615-75-C-3096)

The flow time required for structural engineers to conduct sophisticated analyses of military aerospace structures has markedly reduced the impact of extremely powerful analytical tools that currently exist and are available to the engineering community. The objective of this effort is to begin synthesizing this analytical capability and provide the required interface to allow structural engineers to easily interact with it in a fast and efficient manner. The engineer's ability to quickly respond to structural problems will provide him with more realistic options from which to make design decisions, which inevitably will affect cost, reliability and maintainability of the structure in both the acquisition and operational environment.

A computer program will be written to allow the structural engineer to effectively review, and interact with, the voluminous input data normally associated with finite-element programs, and further provide him with a mechanism for effectively reviewing the results of a finite- element analysis. The program will emphasize the vector graphics mode of operation and will interface with many finite-element programs.

ADDENDA: Supporting agency address is: AF Flight Dynamics Laboratory FBR, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, IMAGING OF SURFACES AND DEFECTS OF CRYSTALS
J.M. COWLEY, Arizona State University, School of Liberal Arts, *Tempe, Arizona* 85281 (EY-76-S-02-2995)

The new techniques evolved by the Principal Investigator and associates for the study of surface structure include the use of medium energy (1 to 15keV) electrons in an ultra-high vacuum equipment for electron diffraction and scanning electron microscopy using either secondary electrons or electrons diffracted by crystal surfaces. It has been shown by theoretical analysis and initial experiments that this system can give information not available by use of other techniques. Parallel techniques for the use of a 100 keV electron microscope in a reflection diffraction mode have been evolved to provide high-resolution information under more restricted operating conditions. By use of these methods information on the morphology of solid surfaces can be combined with information on the crystal structures and the crystal defects in surface layers. This provides a powerful means for the study of chemical reactions on surfaces and physical modifications of surface structure. Applications planned include studies of the oxidation of metal single crystals, the reduction of oxide crystal surfaces and various interactions of graphite crystals.

RESULTS: The sensitivity of the diffraction-imaging mode for the detection of low-angle grain boundaries and crystal defects has been demonstrated with graphite crystals. Experiments on the oxidation of thin single-crystal films of copper held on solid supporting substrates and oxidized under low-pressure, high-temperature conditions have revealed the important role played by metal migration and the formation of thin coherent single-crystal oxide films as well as large oxide crystals nucleated at surface steps.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0002, EXCITATION OF H2 BY LOW-ENERGY ELECTRON IMPACT
R.J. ANDERSON, Univ. of Arkansas, School of Arts & Sciences, *Fayetteville, Arkansas* 72701 (ATM74-12756 A01)

This grant funds an ongoing experimental investigation of electron impact excitation of H2. Particular work to be performed includes completion of cross-section data analysis for the excited triplet states of H2, and measurements of radiative lifetimes for a variety of excited states. Estimates of direct excitation cross sections will be obtained and compared with available theoretical calculations. This work will contribute to our basic understanding of molecular structure, as well as giving useful results for the study of planetary atmospheres.

SUPPORTED BY U.S. Natl. Science Foundation

8.0003, COMPUTER SIMULATION OF PLASMAS
J.M. DAWSON, Univ. of California, School of Letters & Science, *Los Angeles, California* 90024 (PHY76-83686)

Research on the computer simulation of plasmas will continue. Four main topics will be pursued: the generation of radiation by intense electron beams ('free electron laser'); the collective acceleration of particles by intense electromagnetic waves propagating in a plasma; plasma and heat transport across magnetic fields; the application of computers to plasma diagnostics, particularly microwave holography.

This research is a continuation of that initiated under NSF grant PHY74-15233A01.

SUPPORTED BY U.S. Natl. Science Foundation

8.0004, MICROSCOPIC PARAMETERS OF TRANSITION METAL SUPERCONDUCTORS
T.H. GEBALLE, Stanford University, School of Engineering, *Palo Alto, California* 94305 (DMR76-21575)

In this extension of the work carried out under NSF grant DMR74- 21982, microscopic parameters of importance in the superconductivity of transition metal elements, alloys, and compounds which have conduction bands with appreciable d and f components will be investigated using two newly developed methods. The first involves tunneling into amorphous films of elements such as V and La which are deposited at low temperatures and in high vacuum upon previously prepared Al-Al2O3 strips. The phonon density of states weighted by the electron-phonon coupling constant is then studied as the sample is annealed into the crystalline state. The second set of experiments is concerned with near neighbor interactions and distances which can be followed by X-ray absorption fine structure spectroscopy using Synchrotron Radiation. Particular efforts will be directed to examining the changes within the unit cell which occur during the martensitic transitions in Nb3Sn and V3Si in order to compare with Nb3Ge.

SUPPORTED BY U.S. Natl. Science Foundation

8.0005, ORGANIC AND ORGANO-METALLIC CONDUCTORS AND SUPERCONDUCTORS
W.A. LITTLE, Stanford University, School of Hum. & Sciences, *Palo Alto, California* 94305 (DMR76-82087)

The overall goal of this project is to advance our knowledge of the solid-state physics and chemistry of compounds containing strongly interacting substructures so their physical properties can be understood, designed and predicted. Part of this work is concerned with the broad question of the attainability of high-temperature superconductivity through systematic study of linear chain compounds. This includes the synthesis of polarizable ligand systems, plus model studies of stacked arrays of square planar complexes and the effects of oxidation upon them. Physical properties are measured and studies made of theoretical problems bearing on high Tc (critical temperature) materials.

This is the first year of a three-year continuing grant; research has been supported under DMR74-00427 AO2.

SUPPORTED BY U.S. Natl. Science Foundation

8.0006, MATERIAL SUPPORT TECHNOLOGY - STUDY OF HETEROJUNCTION DISCONTINUITIES IN SEMICONDUCTORS
E.A. KRAUT, Rockwell International Corp., *Thousand Oaks, California* 91320 (DN775015; N00014-76-C-1109)

Development of many new electron devices for Navy surveillance and communications electronics systems will require better understanding and control of heterojunctions in semiconductors. Theoretical and experimental studies of the electronic properties of semiconductor- semiconductor junctions will lead to new classes of devices and better understanding and control of devices already being studied by the DoD.

Using the tight binding method in the theory of the solid state, the electronic properties of the valence band discontinuity at the interface between two different semiconductors will be calculated. The model will consider atomic planes parallel to an abrupt junction using the LCAO method with wave functions as two-dimensional Bloch functions. Calculations will account for absolute energy scales as determined by atomic ionization potentials and the degree of covalent bonding in the semiconductors. The systems of interest involve the III-V compound semiconductors and the group IV elemental semiconductors. Abrupt junctions will be grown using molecular beam epitaxy. Measurements will be made in situ on thin films during growth using X-ray photoelectron spectroscopy. By using data from the chemical shifts it will be possible to extract information as to the changing chemical and electrical environment as a function of depth through the interface. In both phases of study, interface states and band bending will be considered.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

8.0007, STUDY OF FUNDAMENTAL NUCLEAR INTERACTIONS
J.J. KRAUSHAAR, Univ. of Colorado, School of Arts & Sciences, *Boulder, Colorado* 80302 (EY-76-C-02-0535)

The experimental program is directed toward a basic understanding of nuclear reaction mechanisms and investigation of several different aspects of nuclear structure using the cyclotron facility at the Nuclear Physics Laboratory. Studies, both theoretical and experimental, that relate to the role of two-step processes in light-ion nuclear reactions such as (3He,t) and (p,t), as well as (p,n) and certain single-nucleon transfer reactions, are at the center of the program. The energy dependence of nuclear reactions is being studied as a test of our understanding of the reaction mechanism. Proton pairing studies are proposed using the (3He,n) reaction for nuclei having an atomic number around 40 or 50, as well as the deformed nuclei in the rare-earth region. The (alpha, p) and (alpha, n) reaction will be used in a study of the transitional nuclei near A equals 100, 153, and 210. The programs in astrophysics and medical physics will be continued. The theoretical studies are about equally divided between low energy (two- step and finite-range effects) and medium-energy (high-energy nucleon transfer reactions, optical potentials for low-energy pions, etc.). The experimental program in medium-energy physics consists of efforts to complete the EPICS spectrometer at LAMPF, analysis of data accumulated last summer on pion induced nucleon removal cross sections and setting up and taking data on five experiments that have been approved for beam time on HRS and EPICS.

RESULTS: The (3He,n) reaction has been used to investigate proton pairing in several mass regions and low-lying 0 plus intruder states have been unexpectedly discovered. The study of (p,t) and (3He,t) reactions has revealed the important

role that two-step processes play in these reactions. Detailed nucleon structure information has been determined for a number of nuclei. New insight on the manner in which pions interact to remove neutrons from nuclei has been gained from the study of light nuclei using the EPICS channel at LAMPF.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0008, LASER SPECTROSCOPY OF SOLID-STATE ELECTROLYTES
J.F. SCOTT, Univ. of Colorado, School of Arts & Sciences, *Boulder, Colorado* 80302 (DF046000; AF-AFOSR-3105-77)

AF function - this proposed research primarily falls in the 5.3 research objectives which deal with electrical power from non-nuclear energy sources. In particular, the use of superionic conductors as solid electrolytes has high potential for development of new batteries and energy storage devices. These batteries will be used for electrical power in manned and unmanned aircraft, satellites and space stations, as well as electrical power unattended ground-based systems. Deficiency - substantial improvements are needed in organic and solid electrolytes to increase conductivity to that achieved in aqueous electrolytes. These solid electrolytes have a much wider temperature range and are needed to be used in new high energy, high charge and discharge rates rechargeable batteries in future aircraft applications as well as space applications. Objective - it is proposed to study the solid-state electrolytes penta- pyridinium silver-iodide, silver-iodide tungstate, and related materials by the technique of laser spectroscopy. Solid-state batteries developed at Sandia in 1972 offer significant advantages over conventional thermal batteries--lower operating temperatures, wider temperature range of operation, simpler chemistry, non-hygroscopic materials, and the ability to withstand large external forces. The objective is to develop a material with these characteristics with the higher current and energy density characteristics of conventional batteries. Contribution - this research is a part of a comprehensive program in superfluids and superconductors.

The approach to be taken is to characterize the spectral response of solid-state electrolytes from about 1H sub 2 to 10 to the 14th power H sub 2, in a nearly continuous fashion. To do this double and triple monochromators, optical furnaces, cryostats, argon and krypton lasers, trip-passed Fabry-Perot and autocorrelation spectroscopy apparati with on-line computer will be used. It is proposed to make optical studies of two silver-iodide based solid-state electrolytes-penta-pyridinium silver-iodide, a two-dimensional electrolyte analogous to b-aluminas, an Ag (13) I (9) W (2) 0 (8), a new system whose structure was only recently determined at the University of Colorado. Comparison of this spectra of Ag (13) I (9) W (2) 0 (8) with Ag (2) W 0 (4), which has recently been grown as large single crystals, will be made. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Defense - Air Force

8.0009, FUNDAMENTAL ASPECTS OF THE THEORY OF ATOMIC COLLISIONS
W. LICHTEN, Yale University, School of Arts & Sciences, *New Haven, Connecticut* 06520 (PHY74-09408 A03)

Research initiated under NSF Grant PHY74-09408 will be continued. Theoretical work on the electron promotion model of many electron atomic collisions will be extended to include: 1. the non-crossing rule and the nature of avoided crossings; 2. basis sets in one-electron calculations; 3. rigorous calculations in systems with small numbers of electrons; 4. model calculations in many electron systems.

Particular attention will be given to phenomena in the outer shells of the collision complex. These include the Rosenthal oscillations and polarization of light emitted by the colliding atoms.

SUPPORTED BY U.S. Natl. Science Foundation

8.0010, MATERIAL SUPPORT TECHNOLOGY - FAR INFRARED OPTICAL AND MAGNETOOPTICAL STUDIES OF SEMICONDUCTORS
S. PERKOWITZ, Emory University, School of Arts & Sciences, *Atlanta, Georgia* 30322 (DN675255; N00014-76-C-0429)

The Navy has application for new semiconductor materials that offer improved performance in electronic systems. This program will provide measurements of optical properties of several materials in the far infrared region to provide information on the basic free carrier, lattice, impurity, and coupled interactions.

Far infrared optical and magnetooptical reflection and transmission measurements will be made in III-V, III-VI, and IV-VI semiconductors and their alloys with particular emphasis placed upon the II-V ternary solid solutions. These data will be utilized to investigate dielectric behavior, coupled phonon-plasmon modes, and free carrier properties of the materials. The role of multiple coupled oscillators in the dielectric behavior will be investigated. Polaron coupling and the role of plasma interactions in narrow-gap materials will be investigated.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

8.0011, GENERATION AND DETECTION OF MICROWAVE PHONONS IN SEMICONDUCTORS
J.A. DAVIS, Illinois Inst. of Technology, School of Liberal Arts, *Chicago, Illinois* 60616 (DMR76-24466)

The generation and detection of microwave phonons in a semiconductor such as InSb will be investigated. This will be done by monitoring the free carrier absorption of light at various laser wavelengths in the far infrared. The laser frequency will be varied in order to probe the amplification of acoustic flux at different phonon frequencies. This will enable us to investigate acoustoelectric interactions due to both deformation potential and piezoelectric coupling in a frequency region which has not been readily accessible otherwise. The theory of both linear and nonlinear acoustoelectric interactions will be extended into this region of high ultrasonic frequencies.

SUPPORTED BY U.S. Natl. Science Foundation

8.0012, NONLINEAR OPTICAL PROPERTIES OF LIQUID CRYSTALS 14280-P
G.K. WONG, Northwestern University, Graduate School, *Evanston, Illinois* 60201 (DA0E9285; DAAG29 77 G0009)

To study the laser-induced nonlinear optical effects in liquid crystal material. Intense laser light interacting with liquid crystal materials may produce completely new physical phenomena. New electrooptical devices are possible and will be explored.

To study the static field-induced second harmonic generation in the isotropic phase of liquid crystal. In the absence of a dc field, the orientation of the molecules in the liquid crystal is randomly distributed and, therefore, would interfere destructively and have no significant second harmonic generation. When a dc electric field is present and new alignment induced, the liquid crystal material can give rise to coherent second harmonic generation. The second experimental pprgram will be to study the optical field-induced isotropic nematic phase transition. Sum frequency generation, three-wave mixing and dispersion of optical Kerr effect: it is planned to study three-wave mixing in both the anisotropic and isotropic phase of nematic liquid crystal.

ADDENDA: Supporting agency address is: DARCOM Army Research Office, Box 12211, Research Triangle Park NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

8.0013, THEORY OF SUPERIONIC CONDUCTORS
G.D. MAHAN, Indiana University, School of Arts & Sciences, *Bloomington, Indiana* 47401 (DF045800; AF-AFOSR-3106-76)

AF function - this proposed research primarily falls in the 5.3 research objectives which deal with electrical power from non-nuclear energy sources. In particular, the use of superionic conductors as solid electrolytes has high potential for development of new batteries and energy storage devices. These batteries will be used for electrical power in manned and unmanned aircraft, satellites and space stations, as well as electrical power for unattended ground-based systems. Deficiency - substantial improvements are needed in organic and solid electrolytes to increase conductivity to that achieved in aqueous electrolytes. These solid electrolytes have a much wider temperature range and are needed to be used

in new high energy, high charge and discharge rates rechargeable batteries in future aircraft applications as well as space applications. Objective - the objective is to investigate two aspects of superionic conductors. First, models of phase transitions will be studied using methods developed by the pi calculations. Phase boundaries will be made for the lattice structures which occur in many superionic conductors. New techniques to study the quantum lattice gas model will be developed and related to superionic conductors. The second aspect is to develop theories of light scattering from superionic conductors. Contribution - this research is a part of a comprehensive program in superfluids and superconductors.

It is proposed to use the periodic cluster method of Nauenberg and Nienhuis to find phase boundaries of three-dimensional systems. So far, all results using the cell method have been for two-dimensional structures. A trick to get around the computational problem has been found. If one takes cells of four spins, each three-dimensional lattice goes into a different one. One can form a cycle of the form sc-bcc-fcc- sc-,etc. Each renormalization step has four spins with four cells which is easily handled by the computer. The results without the magnetic field have been done and accurate results for the transition temperature have been completed. It is proposed to add the magnetic field and do the cycle for this case. The fluorite lattice will be done first, since it is a structure which represents many superionic conductors, then some of the AgI compounds will be tried. It is also proposed to investigate whether the renormalization group method can be used to evaluate ionic conductivity. (Text Abridged.)

SUPPORTED BY U.S. Dept. of Defense - Air Force

8.0014, THE STRUCTURE OF NUCLEI FAR FROM BETA STABILITY

E.F. ZGANJAR, Louisiana State Univ. Systems, School of Arts & Sciences, *Baton Rouge, Louisiana* 70803 (EY-76-S-05-4935)

Studies on nuclei far from the line of beta stability is the central aspect of this research. The work is primarily involved with neutron-deficient nuclei produced at the Oak Ridge Isochronous Cyclotron (ORIC) and mass separated, prior to spectroscopic analysis, by the UNISOR isotope separator which is operated on-line to ORIC. Work on several neutron-rich species via on-line mass separation of fission products has been proposed. The underlying objective of the experiments is to test and further refine the concept of a particle (or hole) moving in a moderately deformed and possibly triaxial potential; and to elucidate the weak yields strong, spherical yields deformed and prolate yields oblate types of transitions. The past work has centered on the neutron-deficient nuclei around the closed proton shell at Z equals 82. Similar studies are proposed for nuclei in the 50 less than or equal to (Z,N) less than or equal to 82 region.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0015, THE INVESTIGATION OF THE FAR INFRARED PROPERTIES OF SEMIMETALS AND DEGENERATE SEMICONDUCTORS

H.D. DREW, Univ. of Maryland, School of Arts & Sciences, *College Park, Maryland* 20742 (DMR73-02398 A03)

Far infrared optical and magneto optical studies of semimetals and semiconductors previously supported by NSF grant DMR-7302398A01 will be continued. The coupling between excitons associated with cyclotron resonance transitions and spin-flip resonance transitions in bismuth will be investigated. Possible excitonic effects in transitions associated with the electron pockets, for which the extreme quantum conditions would prevail, also will be studied including the effects of temperature and electron lifetime on the excitonic modes. It is also planned to look for a possible excitonic phase transition in Bi that would involve the novel excitonic states previously introduced. The study of PbTe will be continued. These studies are providing an improvement of the band structure characterization of this material in addition to the prospect of the observation of excitons similar to those in Bi except that they would be bound by the phonon-mediated electron- electron interaction. Similar studies will be done on Pb 1-x SnxTe. Other materials that have prospects for similar excitonic features are graphite, which can be put into the extreme quantum limit, and Al, which has a parallel band absorption at visible wavelengths.

SUPPORTED BY U.S. Natl. Science Foundation

8.0016, MATERIALS SUPPORT TECHNOLOGY - PHOTO AND IMPURITY EFFECTS IN AMORPHOUS COVALENT SYSTEMS AND FORMATION OF AMORPHOUS METALLIC ALLOYS

D. TURNBULL, Harvard University, School of Arts & Sciences, *Cambridge, Massachusetts* 02138 (DN775040; N00014-77-C-0002)

Recent research results indicate unique properties of amorphous materials suggesting possible Navy use in soft magnet applications, photosensitive materials, high-strength reinforcements, magnetic bubble materials, etc. This effort will investigate several factors which affect the structure and properties of these interesting materials.

This program will explore the photosensitive nature of A-As2Se3 and compare the results to A-Se, which has previously been shown to crystallize as a result of photoillumination. Factors affecting retention of the amorphous state in metals will be determined. Of special interest are compositional and thermal effects on formation and crystallization of these glassy metals. Accordingly, diffusivity and viscosity behavior below tg will be determined.

ADDENDA: Supporting agency address is: Office of Naval Research, Arlington, VA 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

8.0017, THE THEORY OF HIGH-ENERGY COLLISION PROCESSES

T.T. WU, Harvard University, School of Arts & Sciences, *Cambridge, Massachusetts* 02138 (EY-76-S-02-3227)

Strong interaction at high energies has the following properties: 1. Relativistic kinematics; 2. particle production; 3. unitarity; and 4. isospin invariance. On the basis of relativistic quantum field theory that has the first three properties, we have obtained a simple physical picture, called the impact picture, which gives a number of unusual predictions, some of which have been experimentally verified. In particular, a year ago, an experimental result from CERN Intersecting Storage Rings verified the prediction of the rising plateau for pionization.

The next step is to build models for hadron scattering and production at extremely relativistic energies. One approach is to find exactly solvable models, which are presumably not realistic, while an alternative approach is to construct approximate models that incorporate as many as possible of the features learned from our previous study of the high-energy behavior of quantum field theories. Both approaches are being pursued.

RESULTS: We have developed a comprehensive theory for scattering processes at extremely high energies. Two of our early predictions, the increase of total cross sections and total elastic cross sections, were drastically verified by experiments at CERN Intersecting Storage Rings. A year ago, a new experimental result from ISR verified the prediction of the rising plateau. Many more predictions on diffractive and pionization processes remain to be tested, and systematic theoretical studies for scattering and production amplitudes on the basis of models are being pursued.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0018, SEMICONDUCTOR GROWTH BY HEM FOR HIGH-ENERGY LASERS AND ENERGY CONVERSION

D.J. VIECHNICKI, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0E4804)

Semiconductors formed by melt processing via the heat exchanger method (HEM) offer the opportunity to overcome pacing materials problems in the areas of high-energy lasers (HEL) and energy conversion. Large single crystals of germanium are needed as laser windows at 10.6 micrometer. Low-cost silicon sheet material is needed for solar areas for direct conversion of solar energy to electricity. Thrust - high- energy lasers, and energy conversion.

The feasibility of growing germanium and silicon by HEM will be studied. Techniques for constraining the seed crystal at the bottom of the crucible will be developed. Crucible melt capability, sources of starting materials, and growth parameters for 5cm

and 7.5cm diameter crystals will be investigated. Scale-up potential will be evaluated. Crystals will be characterized by X-ray, optical, infrared, and electrical methods.

ADDENDA: Supporting agency address is: DARCOM Materials & Mechanics Research Center, Watertown MA 02172

SUPPORTED BY U.S. Dept. of Defense - Army

8.0019, MAGNETIC INVESTIGATION OF SOME NEW QUASI TWO-DIMENSIONAL MAGNETIC SYSTEMS
J.E. DRUMHELLER, Montana State University, School of Letters & Sciences, *Bozeman, Montana* 59715 (DMR76-82089)

The magnetic properties of several quasi-two-dimensional compounds with the basic K2NiF4 structure will be studied. Three methods will be used: electron paramagnetic resonance (EPR), magnetic susceptibility and magnetic specific heat, in order to study the origin of the anisotropy and to measure the ratio of isotopic to anisotropic exchange. The EPR experiments will be used to measure g-tensors, to determine the phonon modulation of the symmetric exchange integral, to measure the anomalous line-width versus angle behavior in spin diffusion and to establish the ratio of interchain to intrachain coupling in linear magnetic systems. Magnetic susceptibility measurements can be used to determine the nature of the interchain and intrachain exchange and the anisotropy of the magnetic spin systems. Specific heat measurements will be used to determine spin-flop behavior in antiferromagnets and to determine the next nearest and the next-next nearest neighbor exchange effects.

This is a continuation of research supported under DMR75-01296. This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. Natl. Science Foundation

8.0020, SYNTHESIS AND PROPERTIES OF LIMITED-DIMENSIONALITY CONDUCTORS
C.J. ECKHARDT, Univ. of Nebraska, School of Arts & Sciences, *Lincoln, Nebraska* 68508 (DMR76-81603)

The object of this research is the investigation of novel materials which are expected to be extremely anisotropic in their electronic properties. Under study are single crystals of three distinct classes of a group of channel compounds formed by stacking cyclodextrin rings around a conducting spine, organochalcogen-iodine chain complexes, and tetraazaporphyrin metal complexes. In these compounds, there is considerable flexibility for chemical alterations of the structures, with consequent possibilities for designing electronic or optical material with interesting or desirable properties as well as designing truly linear conductors. Optical and high-field galvanomagnetic measurements will be performed on these substances and on some of the already known limited-dimensionality mechanisms, electronic structure, and nonlinear optical properties of highly anisotropic materials.

The experimental research consists of electrical, magnetic and optical measurements. The electron transport and magnetic measurements include electrical conductivity, thermo-electric power, galvanomagnetic effects, and magnetic susceptibility. Optical measurements include polarized reflection spectra, piezomodulation spectra, and photoconductivity. Theoretical work is performed in the electronic structure, stacking arrangement, and optical properties of limited- dimensionality conductors.

The results of this research should contribute to our understanding of: (1) the relationship between the electronic structure and conduction properties of complex, quasi-linear compounds, (2) design criteria for controlling electrical and optical properties of materials by molecular manipulations, (3) conductivity mechanisms in quasi-linear compounds containing complex molecular units, and (4) methods for influencing low- temperature structural instabilities in materials of this general class.

This is a continuation of research supported under DMR75-01058 A02.

SUPPORTED BY U.S. Natl. Science Foundation

8.0021, ELECTRONS IN COMPLEX SOLIDS
D.J. SELLMYER, Univ. of Nebraska, School of Arts & Sciences, *Lincoln, Nebraska* 68508 (DMR76-17417)

Investigation of electronic and magnetic states in relatively complex solids previously supported by NSF grant DMR72-03208 will be continued. These materials either exhibit new types of physical phenomena or require new theoretical models for their understanding. Several classes of problems will be studied; (1) complex ordered solids; (2) spin-polarized electron states in metallic compounds; (3) localized moments and magnetic clusters in dilute alloys; and (4) electronic and magnetic states in amorphous metallic alloys. The experimental work will consist of de Haas-van Alphen measurements, in fields up to approximately 100 kG, in a super-conducting solenoid, and high-field magnetoresistance measurements on selected compounds. In systems where localized magnetic moments or magnetic phase transitions are involved, electron transport, magnetic susceptibility, and high-field magnetization measurements will be performed. The results should contribute to our understanding of (1) the relationship between electronic structure and chemical bonding in structures where the bonding is poorly understood, (2) the localized-moment and itinerant- electron aspects of magnetism in conducting solids, (3) the nature of the magnetic interactions and clusters in some two-dimensional and sd- band metals, and (4) the dependencies of the electronic and magnetic properties of glassy metals on fluctuations of exchange constants, local anisotropy, charge transfer, and structural effects.

SUPPORTED BY U.S. Natl. Science Foundation

8.0022, VORTICITY AND THERMO-ROTATION IN SUPERFLUID HELIUM
W.I. GLABERSON, Rutgers the State University, School of Arts & Sciences, *New Brunswick, New Jersey* 08903 (DMR76-82339)

This work is a continuation of work begun under NSF Grant No. DMR73-07515 and an extension to new experiments. Superfluid and normal properties of Helium-3, Helium-4 and mixtures of Helium-3 and Helium-4 will be studied using a number of different techniques. In one series of measurements vortex pinning forces and superfluid turbulence will be studied using thermo-rotation measurements in Helium-4. In another series of measurements the interaction of a vortex with charged ions will be studied by measuring the capture cross section of vortices for ions and by measuring both the thermal and non-thermal escape of ions from vortices. As time and resources permit, an effort will be made to study the thermal boundary resistance between liquid helium and cerium- magnesium nitrate.

SUPPORTED BY U.S. Natl. Science Foundation

8.0023, MULTIPLE X-RAY DIFFRACTION EFFECTS IN SINGLE CRYSTALS
B. POST, Polytechnic Inst. of New York, School of Science & Engin., *Brooklyn, New York* 11201 (DMR77-02532)

This investigation will be a study of the nature and techniques of multiple diffraction of X-rays by crystals, and the application to selected problems in materials science and solid-state science. The study will include highly precise lattice constants of crystals such as gallium arsenide, gadolinium gallium garnet, and magnetic oxides.

In addition, the experimental determination of phase relationships among X-ray reflections from single crystals will be made. This will be done by analyses of the intensity distributions in the X-ray fine structure of reflections recorded under conditions of multiple diffraction. The research will be broadened from the study of perfect crystals to less perfect crystals.

This is a continuation of research initiated under NSF Grant DMR75- 23680.

SUPPORTED BY U.S. Natl. Science Foundation

8.0024, EXPERIMENTAL INVESTIGATION OF SHAPE ISOMERS, SPIN ISOMERS, AND RELATED TOPICS WITH THE INNER-SHELL-VACANCY DETECTOR
D.D. CLARK, Cornell University, School of Arts & Sciences, *Ithaca, New York* 14853 (PHY77-07751)

The research program consists of development of a new type of efficient detector of transitions between very closely spaced nuclear energy levels and its application to fission, and nuclear

spectroscopy studies. The instrument, called an inner-shell vacancy (ISV) detector, senses vacancies in atomic electron shells created by the nuclear transition. Fission isomers, and spin-gap isomers will be formed using reactions induced by neutrons from the Cornell University TRIGA reactor. Their decay properties will be studied using the ISV detector. The results of the study will contribute to our understanding of the nuclear fission process; the entire project is thus energy related.

This work is a continuation of work currently supported by Foundation grant PHY74-07649 A01.

SUPPORTED BY U.S. Natl. Science Foundation

8.0025, ATOMIC BEAM STUDIES AND NEAR-EQUILIBRIUM PLASMAS
B. BEDERSON, New York University, School of Arts & Sciences, *New York, New York* 10012 (PHY74-03999 A03)

Research will continue on several topics of current interest in atomic physics. This will include: electron scattering by excited states of atoms; D.C. electric dipole polarizabilities of neutral atoms and molecules; development of a new source of polarized electrons; electron scattering by alkali atoms.

This work is a continuation of that currently supported by Foundation grant PHY74-03999A02.

SUPPORTED BY U.S. Natl. Science Foundation

8.0026, STUDIES OF SOLIDS BY POSITRON ANNIHILATION
W. BRANDT, New York University, School of Arts & Sciences, *New York, New York* 10012 (DMR76-81771)

The experimental and theoretical studies of positrons in solids previously supported by DMR74-11678 A02 will be continued. Efforts will be directed to further development of the theoretical basis for the positron method, the measurement of the transport properties of positrons in solids, and expansion of the analysis of positronium formation processes in dipolar and photomagnetic substances, and the investigation of the interaction of positrons with solid surfaces.

This is the first year of a 3-year continuing grant.

SUPPORTED BY U.S. Natl. Science Foundation

8.0027, PARTICLE AND QUANTUM FIELD THEORY INVESTIGATIONS
A. SIRLIN, New York University, School of Arts & Sciences, *New York, New York* 10012 (PHY74-22218 A02)

The investigators will study 1) quark confinement and renormalization induced symmetries in asymptotically free non-Abelian gauge theories, 2) complete the formulation of zero-mass model and study normal products associated with more than one point in renormalized perturbation theory, 3) complete the current algebra formulation of radiative corrections to Fermi transitions in the framework of the gauge theories, study the radiative corrections to Pi 2 and Kl 2 decays and the associated problem of electron-muon universality and investigate non-topological soliton solutions in 4-dimensional gauge theories, 4) investigate an exactly soluble model of quantum electrodynamics in 4 space time dimensions, 5) study classical and quantum soliton solutions of nonlinear field theories in view of a generalization of the inverse-scattering-transform method, 6) pursue the geometrical approach to non-Abelian gauge theories, particularly the metric approach in a higher dimensional space.

This work is a continuation of that currently supported by NSF Grant PHY74-22218 A01 and PHY74-21778 A01.

SUPPORTED BY U.S. Natl. Science Foundation

8.0028, ELECTRONIC STRUCTURE OF HIGH-TEMPERATURE SUPERCONDUCTORS
S.J. WILLIAMSON, New York University, School of Arts & Sciences, *New York, New York* 10012 (DMR76-02043)

In this study, previously funded by A.R.O.D., an experimental investigation to determine key features of the electronic structure of the technologically important A-15 superconductors will be carried out. Recent neutron irradiation experiments have demonstrated that Tc in these materials is dramatically degraded by exposure to high-energy neutrons, and the reduction correlates with increasing crystalline disorder, or departure from A-15 symmetry. The study will be directed toward establishing why Tc is so sensitive to the crystalline structure. The high Tc is attributed largely to the high density of electronic states at the Fermi level, which different band models indicate should be unusually sensitive to a tetragonal distortion of the cubic lattice. These models will be tested by measuring the magnetic susceptibility of V3Si and Nb3Sn crystals subjected to uniaxial stress and comparing the results with predictions of the models. The Young's modulus, shear elastic modulus Cs equals 1/2 (C11 minus C12), and Tc, all of which should vary nonlinearly with strain, will also be determined. Thus, in a given sample the electronic density of states will be varied in a controlled manner and the resulting change in elastic constants and Tc will be observed. This will provide an important test for models which have been proposed to explain the microscopic basis for the lattice instability and the relation between soft phonon modes, the density of states, and Tc. An experimental and theoretical program now well underway, on the normal and superfluid properties of He3, to study the response of the liquid to transversely polarized ultrasound will be continued. On successful completion, this program will yield the first direct observation of the effect of transverse zero sound in liquid He3 and it will provide a unique new tool for the study of the superfluid phases of He3.

SUPPORTED BY U.S. Natl. Science Foundation

8.0029, COHERENCE THEORY WITH SPECIAL REFERENCE TO ENERGY TRANSFER BY ELECTROMAGNETIC RADIATION 14074-P
E. WOLF, Univ. of Rochester, School of Arts & Sciences, *Rochester, New York* 14627 (DA0E9255; DAAG29 77 G0006)

To develop the theory of propagation of coherent electromagnetic radiation through atmospheric media. Relevance - the proposed work is relevant to problems of discrimination in laser radar applications directly related to Electronic Warfare Labs's optical programs and to MICOM's radar programs.

The approach will unify the theory of radiometry, the theory of heat radiation and the theory of radiative transfer at fundamental classical and quantum levels.

ADDENDA: Supporting agency address is: DARCOM Army Research Office, Box 12211, Research Triangle Park NC 27709

SUPPORTED BY U.S. Dept. of Defense - Army

8.0030, PROPERTIES OF QUANTUM SOLIDS, IN PARTICULAR SOLID H2 AND D2
H. MEYER, Duke University, School of Arts & Sciences, *Durham, North Carolina* 27706 (DMR75-23681 A01)

The research program on the properties of solid H2 and D2, previously supported by AROD and ONR, will be continued. The main areas of research to be carried out are: a) A systematic study of the spectral density of rotational fluctuations in dilute ortho H2 at various densities by means of pulsed nuclear magnetic resonance. b) A systematic study of the diffusion motion in solid H2 under pressure. c) A search for the rotational order-disorder transition in solid D2 at para concentrations below 0.5 by means of NMR. d) A study of the crystalline field splitting in solid H2 under pressure. e) Observation of spectral densities of rotational fluctuations in dilute ortho H2 by means of high-resolution neutron scattering.

SUPPORTED BY U.S. Natl. Science Foundation

8.0031, THEORY OF QUANTUM ELECTRODYNAMIC PROCESSES IN THE FIELD OF AN ATOM
R.H. PRATT, Univ. of Pittsburgh, School of Arts & Sciences, *Pittsburgh, Pennsylvania* 15260 (PHY74-03531 A03)

Research initiated under NSF grant PHY74-03531 AO1 will be continued.

Theoretical studies of quantum electrodynamic processes in the field of the atom will be undertaken. These include first-order processes such as atomic photo-effect, radiative capture, bremsstrahlung, and pair production, and second-order processes such

as elastic and inelastic scattering of photons from bound electrons. Work will also continue towards developing an analytic perturbation theory for screened Coulomb wave functions, based on an expansion of the potential convergent in the interior of the atom and leading to wave functions valid in a similar region. Applications to atomic photo- effect and internal conversion will be outlined. Developments in the calculation and understanding of the neutral bremsstrahlung spectrum will be described, with work in progress for the ionic case and for angular distributions. Studies of photoelectric angular distributions, and of the importance of multipole and relativistic effects, will be discussed. Numerical calculations in partial wave formulation for Rayleigh and Compton scattering are to be undertaken.

SUPPORTED BY U.S. Natl. Science Foundation

8.0032, SOLID STATE AND MANY-BODY THEORY
L.N. COOPER, Brown University, Graduate School, *Providence, Rhode Island* 02912 (DMR73-02605 A01)

This research program is a continuation of that supported by NSF grant DMR73-02605 and is concerned with a number of problems in condensed matter and many-body theory. Research will continue on the theory of transport properties, particularly the surface impedence, of pure type II superconductors both above and below the transition temperature in a magnetic field. The nature of the spin interactions in the condensed phases of helium-3, particularly the B phase, will be examined where the aim will be to theoretically describe the 'orbital waves' (a wavelike motion of the preferred direction in the anisotropic pairing state) which have been predicted. New methods for applying the renormalization group techniques to the calculation of critical point phenomena will be further explored. Also the properties of a one- dimensional electron gas in which large momentum change back-scattering processes are allowed will be studied theoretically.

SUPPORTED BY U.S. Natl. Science Foundation

8.0033, THEORETICAL STUDY OF ELECTRON-ELECTRON INTERACTIONS AMONG THE CONDUCTION ELECTRONS IN SOLIDS
J.J. QUINN, Brown University, Graduate School, *Providence, Rhode Island* 02912 (DMR74-01454 A01)

Theoretical investigations of the interaction of conduction electrons in solids previously supported by NSF grant GH-41819 will be continued. Three different but related topics will be investigated. The first is a theoretical investigation of the electron-electron interactions on the properties of a quasi two-dimensional electron gas. The comparison of theory and experiment should clarify the difficult question of which many-body theory works best in the region of intermediate electron densities. In addition, the collective modes and possible phase transition to a Wigner lattice of the two-dimensional electron gas will be investigated. The second topic is the investigation of magneto-plasma surface waves on conducting solids. The work also includes the study of surface excitation of electron-hole plasmas and of surface acoustic waves in metals in the presence of a dc magnetic field. The final topic is the study of the dynamic response function of a metallic surface and using them to study the scattering of photons and electrons by both clean surfaces and surfaces with chemisorbed layers.

SUPPORTED BY U.S. Natl. Science Foundation

8.0034, INTERACTIONS OF MUONS, KAONS, ANTIPROTONS AND SIGMA HYPERONS
M. ECKHAUSE, Coll. of William & Mary, School of Arts & Sciences, *Williamsburg, Virginia* 23185 (PHY76-82083)

An experimental program is proposed which includes two types of research. Studies of muon physics are proposed for execution at the Space Radiation Effects Laboratory and Columbia University's Nevis Laboratory. Studies of exotic atoms involving kaons, antiprotons and sigma hyperon are proposed for execution at Brookhaven National Laboratory.

The muon physics experiments are to continue work investigating the possibility of formation of metastable states of muonic atoms with the intention of developing ways to study neutral weak currents, to continue studies of muonium production in vacua with the intention of studying rare decays of muonium, and to make measurements of muon capture in liquid hydrogen which will give a better value of the lifetime of the negative muon.

At Brookhaven, studies of X-rays emitted by the atom made up of a proton and an antiproton will give information about the strong interaction. These studies, if successful, will be extended to the atom made up of a kaon and a proton, and to other exotic atoms. In addition, a new measurement is proposed for the magnetic moment of the Sigma Hyperon to provide tests of the unitary symmetry theory of strong interaction.

The work is a continuation of that currently supported by Foundation Grant PHY74-24543 A02.

SUPPORTED BY U.S. Natl. Science Foundation

8.0035, A STUDY OF ELECTRON AND UV PHOTON-SURFACE INTERACTIONS
D. LICHTMAN, Univ. of Wisconsin, School of Letters & Science, *Milwaukee, Wisconsin* 53221 (EY-76-S-02-2425)

Studies on electron stimulated desorption will continue. Quantitative cross-section values as a function of bombarding electron energy, substrate temperature and desorbing species (ionic and neutral) will be tabulated. Photodesorption experiments on new materials (e.g., graphite, metal oxides, etc.) will determine if and how they are sensitive to radiation-induced desorption. Efforts will continue to obtain data at shorter wavelengths, i.e., less than 2000A. Multiple beam experiments will continue with major concentration on simultaneous ion and electron bombardment using independently controlled beams. Ion bombardment will also be used for sample cleaning and surface analysis using secondary ion mass spectrometry (SIMS). Auger Electron Spectroscopy (AES) will also be used for surface characterization and analysis. Updating of the critical reviews will continue.

RESULTS: Cross sections for electron-induced desorption of neutrals (approximately 10 to the minus 16th power cm squared) and ions (approximately 10 to the minus 18th power cm squared and less) have been obtained. The effects of electron energy, surface material, and surface temperature have been determined. The mechanism of and cross section for photodesorption have been determined for some materials over the near U.V. range. The role of impurity carbon in the photodesorption process has been established.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - M.F.E.D.

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, STELLAR PROPER MOTION SURVEY WITH THE 13-INCH PHOTOGRAPHIC TELESCOPE OF THE LOWELL OBSERVATORY
H.L. GICLAS, Lowell Observatory, *Flagstaff, Arizona* 86001 (AST-76-08470 A01)

Support is for the continuation for an additional 12 months of the Lowell Observatory program for the discovery of faint stars moving at a high rate of speed across the line of sight and consequently showing large proper motions. High-quality homogeneous photographs made 40 or more years ago with the Lowell 13-inch photographic telescope are compared with similar photographs made with the same telescope today. The photographs, each covering 180 square degrees of sky, are independently examined by two observers for stars of perceptible motion in the brightness range 8th to 17th blue magnitude. After careful measurement, motions of 0.20 arcs seconds per year are retained for publication. Motions for white dwarf star suspects and faint red stars are included to somewhat less than this limit. A color estimate is made from a comparison of a blue and red plate. Also a finding chart is provided for each star to make the objects listed identifiable, hence usable, to other astronomers working with these stars of faint luminosity.

Following completion and publication of the survey of the northern hemisphere of the sky, a survey of the southern sky to declination 30 degrees south of the celestial equator is in progress.

Prior support was by NSF grant AST 76-08470.

SUPPORTED BY U.S. Natl. Science Foundation

10.0002, TRACE ELEMENTS IN METEORITES AND THE AGE OF THE SOLAR SYSTEM

P.K. KURODA, Univ. of Arkansas, Graduate School, *Fayetteville, Arkansas* 72701 (EAR76-00285)

This is a continuation of research supported under NSF grant GA- 26262 and Amendment No.1. This project involves determination of the amounts and isotopic compositions of rare-gas elements, especially xenon, in carbonaceous chondrite meteorites and terrestrial rocks. The data will be used to evaluate the role of different nucleosynthetic and mass-fractionation effects in producing the rare gases now found in carbonaceous chondrites. The studies will provide independent evaluations of the unusual isotopic anomalies discovered for oxygen and magnesium in these meteorites. The information will help determine the early nuclear processes in the sun and the mechanisms of condensation of solid matter in the solar system.

SUPPORTED BY U.S. Natl. Science Foundation

10.0003, MEASUREMENT AND ANALYSIS OF VARIABLE PLANETARY AND EXTRAGALACTIC EMISSIONS AT RADIO AND OPTICAL FREQUENCIES

A.G. SMITH, State University of Fla. Sys., School of Arts & Sciences, *Gainesville, Florida* 32601 (AST76-80830)

A broadly based observational, analytical and theoretical study of variable astronomical sources will be carried out. A continuing major effort centers on long-wavelength radio studies of Jupiter and other outer planets, objects of special current interest because they are the focus of recent and future space missions. A primary objective is understanding the origin of Jupiter's powerful emissions, a topic of even greater interest since the spacecraft discovery of similar radiation from the earth; the investigation includes study of the solar wind and its influence on planetary emissions. A second ongoing major effort involves optical and radio studies of variable extragalactic sources. Here the thrust is toward understanding of the unusual processes that produce enormous variable energies in the quasars and in the nuclei of galaxies -- including, possibly, even 'normal' galaxies such as our own. An adjunct to this program is innovative research in the improvement of photographic technology.

SUPPORTED BY U.S. Natl. Science Foundation

10.0004, THE SPECTRA OF PLANETARY NEBULAE

J.B. KALER, Univ. of Illinois, School of Liberal Arts & Sci., *Urbana, Illinois* 61801 (AST76-20840)

This work will be directed towards an understanding of planetary nebulae and their role in galactic and stellar evolution. A study will be made of the evolution of planetary nebulae and their nuclei in order to determine the relation that exists between their mass, chemical composition, evolutionary state and position in the galaxy. The study will also examine the relation between the observed distribution of these objects in the Hertzsprung-Russell diagram and theoretical models of evolution. Distances to the planetary nebulae will be computed by several methods. An extensive analysis of chemical compositions will be completed, and an examination of galactic abundance gradients will be made. Observations of the absolute and relative line intensities and central star magnitudes will be carried out. This work represents a continuation of studies previously supported by NSF Grant 63-05270 A01.

SUPPORTED BY U.S. Natl. Science Foundation

10.0005, ATMOSPHERES OF COOL STARS

R.K. HONEYCUTT, Indiana University, School of Arts & Sciences, *Bloomington, Indiana* 47401 (AST74-18929 A02)

The structure and chemical composition of the atmosphere of cool stars will be studied. In particular, attempts will be made to ascertain whether abundances can be reliably obtained by the spectrum synthesis technique using spectrophotometry at 2 Angstroms resolution. Some variable stars will be monitored in order to determine whether a particular line-strength variation observed between two stars is due to a change in abundance or a change in atmospheric structure. A program of vidicon coude spectroscopy will be initiated and will involve observations of an early M giant star and an N-type carbon star. Construction of model atmospheres will be continued for giant, supergiant and dwarf stars. The detailed predictions of the model atmospheres will be compared with the observational data obtained and this will provide a means of testing the validity and accuracy of the theoretical models. This is the second year of the three-year continuing grant AST 74-18929A01.

SUPPORTED BY U.S. Natl. Science Foundation

10.0006, HARVARD-SMITHSONIAN-NATIONAL GEOGRAPHIC TOTAL SOLAR ECLIPSE OF OCTOBER 23, 1976 EXPEDITION

D.H. MENZEL, Harvard University, Smithsonian Institution, *Cambridge, Massachusetts* 02138

Our plans are to obtain high-resolution photographs of all aspects of the October 23, 1976, total solar eclipse, especially of the corona during totality. Most of the photography will be in color with the exception of some coronal polarization studies which will be in black and white. Also planned are wide-field photography of the sky and horizon in the vicinity of the eclipsed sun and photography of the flash spectrum.

Our present planned location for this expedition is along the eastern end of the eclipse track in southeastern Australia where the weather conditions are most favorable.

We have obtained, on loan, several high-quality photographic telescopes for this project, and are currently making travel arrangements.

SUPPORTED BY Natl. Geographic Soc. - Washington, D.C.

10.0007, ADVANCE WARNING OF SOLAR ACTIVITY USING SOLAR RADIO INTERFEROMETRY

K.R. LANG, Tufts University, School of Arts & Sciences, *Medford, Massachusetts* 02155 (DF248100; F19628-76-C-0280)

AF function - communications and navigation. Deficiency - medium- range (1 to 7 days) and short-range (min. to 1 day) capability for advance and reliable predictions of operationally disruptive solar activity. Objective - to detect signatures in active region radio emissions that provide advance warning of solar activity. How research contributes - provides a knowledge of the flare precursor mechanism necessary to establish operational forecast techniques that provide advance warning of electromagnetic and particle emissions that disrupt hf communications, OTH radars, and satellite sensors.

Measurements at high resolutions of near 5 arc seconds will be conducted at N.R.A.O. and Haystack-Westford Observatories to find precursors in radio emission prior to flare activity. The sharp resolution of these radiotelescopes will allow the hot pinpoint sources, thought to be flare triggers, to be accurately measured. These and other possible precursors will be assessed for their importance as operational solar activity predictors.

ADDENDA: Supporting agency address is: AF Geophysics Laboratory PH, L.G. Hanscom AFB, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

10.0008, RADIO ASTRONOMICAL OBSERVATIONS OF GALACTIC AND EXTRAGALATIC RADIO SOURCES

F.T. HADDOCK, Univ. of Michigan, School of Lit. Sci. & the Arts, *Ann Arbor, Michigan* 48104 (AST76-24638)

Flux density measurements of extragalactic radio sources have been made regularly since 1961 and will be continued at lambda lambda 2.1cm, 3.8cm and 6.2cm. These measurements will determine the radio spectra of interesting objects at centimeter wavelengths and detect variation with time. The polarization characteristics and variation of these objects determined by accu-

rate measurements of circular polarization and multifrequency measurements of linear polarization will be continued with substantially improved measurement sensitivity. The relationship of linear polarization variations to the source flux densities and to the structures observed by very-long-baseline interferometry will be investigated. Circularly polarized emission at lambda 3.8cm in several variable sources and two other sources have exhibited significant changes of their circular polarization during the time period of measurement.

Emphasis will continue to be placed upon obtaining multifrequency linear polarization, circular polarization and flux density measurements of extragalactic objects. Observations must be made often since the spectra of some of these objects change in time intervals as short as a week at centimeter wavelengths. In addition, monitoring of a number of galactic objects such as Cygnus X-3, which have exhibited rapid variations in flux and large changes in linear polarization, will be continued. This action provides additional funding and extends the duration of the grant AST 7600410 for 12 months.

SUPPORTED BY U.S. Natl. Science Foundation

10.0009, BACKGROUND SKY BRIGHTNESS MEASUREMENTS FOR APPLICATION TO SPACE SURVEILLANCE SYSTEMS

J.L. WEINBERG, State University of New York, Graduate School, *Albany, New York* 12203 (DF044830; AF-AFOSR-3091-76)

AF function - space surveillance activities require a specific knowledge of the background sky brightness in visible and ir wavelength regions. Deficiency - no definitive measurements exist of the background brightness outside the earth's atmosphere. Objective - to determine the sky brightness due to zodiacal light and gegenschein. Data from spacecraft Pioneer 10 and 11 will be used. Contributions - the sky brightness in two spectral bands in the visual will be determined for the entire celestial sphere. These results will contribute to knowledge of the sky brightness in the ir region.

Data exists for measurements from the earth's orbit to beyond Jupiter's orbit. Preliminary results have shown that emission due to zodiacal light and gegenschein is greatly reduced beyond the asteroid belt. The background of interstellar space will serve as a control for determining the absolute emission of the zodiacal light and gegenschein. These measurements have been made in two spectral regions in the visible. These measurements plus polarization measurements will reveal the distribution and composition of the interplanetary dust, thus providing a model for emission to all wavelengths.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NP, Bldg. 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense - Air Force

10.0010, THEORETICAL ASTROPHYSICS

E.A. SPIEGEL, Columbia University, School of Arts & Sciences, *New York, New York* 10027 (PHY75-05660 A02)

Research supported under NSF Grant GP-32336X2 will be continued. Specific topics in theoretical astrophysics to be investigated include: 1. Theory of pulsar magnetosphere (Ruderman); 2. Pulsar radiation mechanisms (Ruderman); 3. Two fluid flows (Spiegel): a) Fluidization, b) Photon bubbles, c) Bioconvection; 4. Relativistic transport theory (Spiegel); 5. Gamma-ray bursts (Ruderman); 6. Neutral currents and neutrino pair emission (Ruderman); 7. Terrestrial ozone and nearby supernovae explosions (Ruderman & Spiegel); and 8. Dense galactic nuclei (Ruderman & Spiegel).

SUPPORTED BY U.S. Natl. Science Foundation

10.0011, PETROLOGY AND MICROCHEMISTRY OF THE UNEQUILIBRATED ORDINARY CHONDRITES

R.T. DODD, State University of New York, School of Arts & Sciences, *Stony Brook, New York* 11790 (EAR75-21801 A01)

This is a continuation of research supported under NSF grant DES74- 21801. The project involves analysis of the chemical and mineralogical compositions of chrondritic meteorites in order to determine the chemical and physical conditions of their formation and subsequent history. Meteorites such as these provide our only record of early events in the solar system, thus the results of this study will help the understanding of the conditions of formation and processes of early evolution of the planets and the solar system.

SUPPORTED BY U.S. Natl. Science Foundation

10.0012, SPECTROSCOPIC OBSERVATIONS OF QUASI-STELLAR RADIO SOURCES

D. WILLS, Univ. of Texas, School of Natural Sciences, *Austin, Texas* 78712 (AST76-81338)

The University of Texas Radio Astronomy Observatory is currently engaged in a deep radio source survey (approximately 5000 sources per steradian), providing arc-second positional accuracy for the sources, which can then be optically identified with quasi-stellar radio sources (QSOs) and galaxies using even more accurate optical positions. Spectroscopic and other optical work on the identified radio sources, using telescopes at the University of Texas' McDonald Observatory, will be carried out.

The programs include the study of large samples of bright and faint QSOs which may be used to investigated the space density and luminosity evolution of QSOs, for quantitative statistical studies of line strengths and their dependence on redshift and other QSO properties, and for studies of interesting individual objects, such as the BL Lac-type ('lineless') objects, the extremely compact N galaxies and Seyfert-type nuclei, and QSOs with complex absorption-line spectra. Ability to carry out these programs is made possible by the availability of digital techniques for accurate quantitative recording of spectra at the University of Texas.

This is a continuation of work previously supported by NSF grant AST76-02372.

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Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N77-26066*+ National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 83, MAY 1977
May 1977 118 p
(NASA-SP-7037(83)) Avail: NTIS HC E02 CSCL 01A

This bibliography lists 360 reports, articles, and other documents introduced into the NASA scientific and technical information system in April 1977. Author

N77-26067*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HELICOPTER OPTIMAL DESCENT AND LANDING AFTER POWER LOSS
Wayne Johnson May 1977 33 p refs Sponsored in part by Army
(NASA-TM-X-73244; A-7047) Avail: NTIS HC A03/MF A01 CSCL 01A

An optimal control solution is obtained for the descent and landing of a helicopter after the loss of power in level flight. The model considers the helicopter vertical velocity, horizontal velocity, and rotor speed; and it includes representations of ground effect, rotor inflow time lag, pilot reaction time, rotor stall, and the induced velocity curve in the vortex ring state. The control (rotor thrust magnitude and direction) required to minimize the vertical and horizontal velocity at contact with the ground is obtained using nonlinear optimal control theory. It is found that the optimal descent after power loss in hover is a purely vertical flight path. Good correlation, even quantitatively, is found between the calculations and (non-optimal) flight test results. Author

N77-26068*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLAP/LAG/TORSION DYNAMICS OF A UNIFORM, CANTILEVER ROTOR BLADE IN HOVER
Wayne Johnson May 1977 19 p refs Sponsored in part by US Army Air Mobility Research and Development Lab., Moffett Field, Calif.
(NASA-TM-73248; A-7063) Avail: NTIS HC A02/MF A01 CSCL 01A

The dynamic stability of the flap/lag/torsion motion of a uniform, cantilever rotor blade in hover is calculated. The influence of blade collective pitch, lag frequency, torsional flexibility, structural coupling, and precone angle on the stability is examined. Good agreement is found with the results of an independent analytical investigation. Author

N77-26069*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOW SPEED WIND TUNNEL TESTS OF 1/10-SCALE MODEL OF A BLENDED-ARROW SUPERSONIC CRUISE AIRCRAFT
H. Clyde McLemore and Lysle P. Parlett Washington, D. C. Jun. 1977 66 p refs
(NASA-TN-D-8410; L-11086) Avail: NTIS HC A04/MF A01 CSCL 01A

Low speed static force tests have been conducted in a full scale tunnel to determine the low speed aerodynamic characteristics of a 1/10-scale model of a blended-arrow supersonic cruise aircraft. A clean configuration and a high lift configuration with several combinations of leading- and trailing-edge flaps to provide improved lift and longitudinal stability in the landing and takeoff modes were used. The tests were made at angles of attack from about -6 deg to 30 deg, sideslip angles from -5 deg to 10 deg, and Reynolds numbers from 6.78 x 1 million to 13.85 x 1 million corresponding to test velocities of 41 to 85 knots. Author

N77-26070*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOW-SPEED WIND TUNNEL TESTS OF 1/9-SCALE MODEL OF A VARIABLE-SWEEP SUPERSONIC CRUISE AIRCRAFT
H. Clyde McLemore, Lysle P. Parlett, and William G. Sewall Washington Jun. 1977 81 p refs
(NASA-TN-D-8380; L-11149) Avail: NTIS HC A05/MF A01 CSCL 01A

Tests were conducted in the Langley full-scale tunnel to determine the aerodynamic characteristics at low subsonic speeds of a 1/9-scale model of a variable-sweep supersonic cruise aircraft. The model configurations investigated were the basic unflapped arrangement, a take-off flap arrangement, and a landing flap arrangement with several strake leading-edge flow control devices. The tests were conducted at angles of attack from about -5 to 36 deg, sideslip angles from -5 to 10 deg. Author

N77-26071# Office of Management and Budget, Washington, D. C.
AIRCRAFT INDUSTRY CAPACITY STUDY
Jan. 1977 73 p
(AD-A037837; DW-77-1) Avail: NTIS HC A04/MF A01 CSCL 05/3

A joint agency study group was formed to examine the capacity and capacity utilization of the aircraft industry. The study group evaluated existing and planned capacity against present and future military, commercial and foreign market demands. The costs to DoD of maintaining extra capacity were estimated, and the contributions of this extra capacity to national surge and mobilization needs, furthering competition and advancing the technology base were assessed. GRA

N77-26072# Boeing Commercial Airplane Co., Seattle, Wash.
ADHESIVE BONDED AEROSPACE STRUCTURES STANDARDIZED REPAIR HANDBOOK Technical Report, 1 Jan. - 30 Sep. 1975
J. E. McCarty, R. E. Horton, M. C. Locke, M. L. Satterthwait, and B. D. Parashar May 1976 75 p refs
(Contract F33615-73-C-5171)
(AD-A035601; AFML-TR-76-65) Avail: NTIS HC A04/MF A01 CSCL 01/3

This report covers the third phase of a five-phase program

to develop a standardized handbook for the repair of bonded aircraft structure. Tasks include the standardization of small repairs that are now covered by the various aircraft technical orders as well as general instructions for large repair work, including component rebuilding. Work completed in Phase III included the fabrication and test of small area repair specimens. Repair methods were demonstrated on seven military aircraft components. This work will serve as a base for procedures to be designated in the handbook. Author (GRA)

N77-26073# Cornell Univ., Ithaca, N.Y. Dept. of Operations Research.

SPAERS: SIMULATION FOR THE PERFORMANCE AIRCRAFT ENGINE REPAIR SYSTEMS M.S. Thesis

Henry Givray and Robert Slon May 1976 194 p refs

(Contract N00014-75-C-1172; NR Proj. 042-335)

(AD-A035737) Avail: NTIS HC A06/MF A01 CSCL 21/5

The allocation of spare aircraft engines is critical to the U.S. Naval aircraft operation's performance. An aircraft in this system becomes inoperative in the event of an engine failure and remains in that state until it is replaced by a serviceable engine. An engine is removed upon failure and subsequently is recovered by repairing it at the location's repair facilities or elsewhere. However, the availability of a spare engine at the location could reduce the amount of time an aircraft spent in an inoperative state due to engine repair time. Analytical models have been developed by the DOD to calculate spare engine requirements throughout the system. The models require assumptions to be made about certain parts of the system. A Simulation for the Performance of Aircraft Engine Repair System SPAERS was developed to simulate different configurations of an aircraft repair system. The analysis section of this report shows a comparison between two situations, namely the analytical rendering of the repair system, and a situation more closely resembling the real system dynamics. GRA

N77-26074# Advisory Group for Aerospace Research and Development, Paris (France).

AGARD HIGHLIGHTS 77/1

Mar. 1977 54 p refs

Avail: NTIS HC A04/MF A01

Papers given at the 12th annual AGARD meeting and presented in this overview of the conference include: Science Policy in Turkey, the Space Transportation System, and the Economics of Research and Development Expenditures and Technical Progress. Discussion topics at symposia of the various panels are briefly described, and the agenda for the 1977 lecture series is announced. A.R.H.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N77-26075*# Lockheed-Georgia Co., Marietta.

ANALYSIS OF THE SEPARATED BOUNDARY LAYER FLOW ON THE SURFACE AND IN THE WAKE OF BLUNT TRAILING EDGE AIRFOILS

S. H. Goradia, J. M. Mehta, and G. S. Shrewsbury Apr. 1977 215 p refs

(Contract NAS1-13985)

(NASA-CR-145202) Avail: NTIS HC A10/MF A01 CSCL 01A

The viscous flow phenomena associated with sharp and blunt trailing edge airfoils were investigated. Experimental measurements were obtained for a 17 percent thick, high performance GAW-1 airfoil. Experimental measurements consist of velocity and static pressure profiles which were obtained by the use of forward and reverse total pressure probes and disc type static pressure probes over the surface and in the wake of sharp and blunt trailing edge airfoils. Measurements of the upper surface boundary layer were obtained in both the attached and separated flow regions. In addition, static pressure data were acquired, and skin friction on the airfoil upper surface was measured with a specially constructed device. Comparison of the viscous flow data with data previously obtained elsewhere indicates reasonable agreement in the attached flow region. In the separated flow region, considerable differences exist between these two sets of measurements. Author

N77-26076*# Rockwell International Corp., Los Angeles, Calif. Aircraft Div.

AERODYNAMIC CONFIGURATION DEVELOPMENT OF THE HIGHLY MANEUVERABLE AIRCRAFT TECHNOLOGY REMOTELY PILOTED RESEARCH VEHICLE

P. B. Gingrich, R. D. Child, and G. N. Panageas Jun. 1977 141 p refs

(Contract NAS4-2276)

(NASA-CR-143841; NA-76-865) Avail: NTIS HC A07/MF A01 CSCL 01A

The aerodynamic development of the highly maneuverable aircraft technology remotely piloted research vehicle (HiMAT/RPRV) from the conceptual design to the final configuration is presented. The design integrates several advanced concepts to achieve a high degree of transonic maneuverability, and was keyed to sustained maneuverability goals while other fighter typical performance characteristics were maintained. When tests of the baseline configuration indicated deficiencies in the technology integration and design techniques, the vehicle was reconfigured to satisfy the subcritical and supersonic requirements. Drag-due-to-lift levels only 5 percent higher than the optimum were obtained for the wind tunnel model at a lift coefficient of 1 for Mach numbers of up to 0.8. The transonic drag rise was progressively lowered with the application of nonlinear potential flow analyses coupled with experimental data. Author

N77-26077*# Washington Univ., St. Louis, Mo. Dept. of Mechanical Engineering.

UNSTEADY HOVERING WAKE PARAMETERS IDENTIFIED FROM DYNAMIC MODEL TESTS, PART 1 Final Report

K. H. Hohenemser and Sam T. Crews Jun. 1977 120 p refs

(NAS2-7613)

(NASA-CR-152022) Avail. NTIS HC A06/MF A01 CSCL 01A

The development of a 4-bladed model rotor is reported that can be excited with a simple eccentric mechanism in progressing and regressing modes with either harmonic or transient inputs. Parameter identification methods were applied to the problem of extracting parameters for linear perturbation models, including rotor dynamic inflow effects, from the measured blade flapping responses to transient pitch stirring excitations. These perturbation models were then used to predict blade flapping response to other pitch stirring transient inputs, and rotor wake and blade flapping responses to harmonic inputs. The viability and utility of using parameter identification methods for extracting the perturbation models from transients are demonstrated through these combined analytical and experimental studies. Author

N77-26078*# Washington Univ., St. Louis, Mo. Dept. of Mechanical Engineering.

APPLICATION OF SYSTEM IDENTIFICATION TO ANALYTIC ROTOR MODELING FROM SIMULATED AND WIND TUNNEL DYNAMIC TEST DATA, PART 2 Final Report

K. H. Hohenemser and D. Banerjee Jun. 1977 194 p refs

(Contract NAS2-7613)

(NASA-CR-152023) Avail: NTIS HC A09/MF A01 CSCL 01A

An introduction to aircraft state and parameter identification methods is presented. A simplified form of the maximum likelihood method is selected to extract analytical aeroelastic rotor models from simulated and dynamic wind tunnel test results for accelerated cyclic pitch stirring excitation. The dynamic inflow characteristics for forward flight conditions from the blade flapping responses without direct inflow measurements were examined. The rotor blades are essentially rigid for inplane bending and for torsion within the frequency range of study, but flexible in out-of-plane bending. Reverse flow effects are considered for high rotor advance ratios. Two inflow models are studied; the first is based on an equivalent blade Lock number, the second is based on a time delayed momentum inflow. In addition to the inflow parameters, basic rotor parameters like the blade natural

frequency and the actual blade Lock number are identified together with measurement bias values. The effect of the theoretical dynamic inflow on the rotor eigenvalues is evaluated. Author

N77-26079*# Washington Univ., St. Louis, Mo. Dept. of Mechanical Engineering.
FINITE ELEMENT STABILITY ANALYSIS FOR COUPLED ROTOR AND SUPPORT SYSTEMS Final Report (Part 3)
K. H. Hohenemser and S. K. Yin Jun. 1977 47 p refs
(Contract NAS2-7613)
(NASA-CR-152024) Avail: NTIS HC A03/MF A01 CSCL 01A

The effects of fuselage motions on stability and random response were analytically assessed. The feasibility of adequate perturbation models from non-linear trim conditions was studied by computer and hardware experiments. Rotor wake-blade interactions were assessed by using a 4-bladed rotor model with the capability of progressing and regressing blade pitch excitation (cyclic pitch stirring), by using a 4-bladed rotor model with hub tilt stirring, and by testing rotor models in sinusoidal up or side flow. Author

N77-26080# Weapons Research Establishment, Salisbury (Australia).
ESTIMATION AT SUBSONIC SPEEDS OF THE LONGITUDINAL AND LATERAL AERODYNAMIC CHARACTERISTICS OF WING-BODY COMBINATIONS AT ANGLES UP TO 90 DEG
K. D. Thomson Sep. 1976 29 p refs
(WRE-Rept-1672(WR/D)) Avail: NTIS HC A03/MF A01

A theory is presented for estimating the normal force and pitching moment characteristics (including the effects of wing-body interference) of wings mounted on bodies. A pair of wings placed side by side can be specified which, when operating at a certain angle of attack different from the geometrical angle of attack, have the same aerodynamic properties as the wings in the presence of the body. The equivalent wings and effective angle of attack are determined, and these enable the wing-body normal force and pitching moment to be estimated for wing-body combinations at angles of attack up to 90 deg. Estimates are also made of the normal force and pitching moment produced by two cone cylinder bodies over the same angle of attack range. Author

N77-26081*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INVESTIGATION OF REAL-GAS AND VISCOUS EFFECTS ON THE AERODYNAMIC CHARACTERISTICS OF A 40 DEG HALF-CONE WITH SUGGESTED CORRELATIONS FOR THE SHUTTLE ORBITER
James L. Hunt, Robert A. Jones, and William C. Woods Washington Jun. 1977 49 p refs
(NASA-TN-D-8418; L-10807) Avail: NTIS HC A03/MF A01 CSCL 01A

Parameters were evaluated that might be used to correlate shuttle orbiter aerodynamic data to be used in extrapolating from wind-tunnel to flight conditions. Preliminary calculations indicate that the lee-side forces will have an insignificant influence on the aerodynamic characteristics of the orbiter for moderate angle-of-attack entries; therefore, this work is focused on phenomena which have an overriding influence on windward forces, namely, real-gas (equilibrium and nonequilibrium) and viscous-interaction effects. Analytically determined flow fields previously obtained on 40 deg blunted cones were used as a data source to evaluate various correlation parameters. Inviscid effects were found to be the dominant contributor to the aerodynamic coefficients in the altitude range of 64 to 76.2 km. The most suitable correlation of the aerodynamic forces on these cones is based on local dynamic pressure and local Mach number. Author

N77-26082*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AIRFRAME, WING, AND TAIL AERODYNAMIC CHARACTERISTICS OF A 1/6-SCALE MODEL OF THE ROTOR SYSTEMS RESEARCH AIRCRAFT WITH THE ROTORS REMOVED
Raymond E. Mineck (Army Air Mobility Res. and Develop. Lab., Hampton, Va.) and Carl E. Freeman (Army Air Mobility Res. and Develop. Lab., Hampton, Va.) Washington May 1977 141 p refs
(DA Proj. 1L1-61102-AH-45)
(NASA-TN-D-8456) Avail: NTIS HC A07/MF A01 CSCL 01A

A wind-tunnel investigation was conducted to determine the aerodynamic characteristics of the rotor systems research aircraft (RSRA) as the helicopter and the compound helicopter with the rotors removed. Data were obtained over ranges of angle of attack and angle of sideslip. Results are presented for the total loads on the airframe as well as the loads on the wing and the tail. The results indicate that the RSRA with the rotors removed has stable static longitidinal and directional characteristics and has stable effective dihedral. Author

N77-26083*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
EFFECT OF WINGLETS ON A FIRST-GENERATION JET TRANSPORT WING. 3: PRESSURE AND SPANWISE LOAD DISTRIBUTIONS FOR A SEMISPAN MODEL AT MACH 0.30
Lawrence C. Montoya, Peter F. Jacobs, and Stuart G. Flechner Washington Jun. 1977 102 p refs Prepared in cooperation with NASA, Langley Res. Center
(NASA-TN-D-8478; L-11370) Avail: NTIS HC A06/MF A01 CSCL 01A

Pressure and spanwise load distributions on a first-generation jet transport semispan model at a Mach number of 0.30 are presented. The data are given for the basic wing and for configurations with an upper winglet only, upper and lower winglets, and a simple wing-tip extension. To simulate second-segment-climb lift conditions, leading- and/or trailing-edge flaps were added to some configurations. Author

N77-26084# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Aeroballistics Directorate.
A SUMMARY OF JET PLUME EFFECTS ON THE STABILITY CHARACTERISTICS OF A BODY OF REVOLUTION WITH VARIOUS FIN CONFIGURATIONS AT MACH NUMBERS FROM 0.2 TO 2.3 NORMAL JET PLUME SIMULATOR
George Batiuk and James H. Henderson 13 Dec. 1976 189 p
(AD-A037356; RD-77-12) Avail: NTIS HC A09/MF A01 CSCL 20/4

This report summarizes the studies made to date by the Army Missile Command on the effects of the rocket jet plume on the Stability characteristics of a body of revolution with various fin configurations and at various fin positions on the body. The Mach numbers ranged from 0.2 to 2.3. A normal jet plume simulator was used to obtain the desired plume effects. This report concerns itself with those tests conducted on a 5-in. diameter, 52-in. long model, with a 3 caliber tangent ogive nose. GRA

N77-26085# Air Force Geophysics Lab., Hanscom AFB, Mass.
COMPUTER PROGRAMS FOR TETHERED-BALLOON SYSTEM DESIGN AND PERFORMANCE EVALUATION Instrumentation Papers
John B. Wright 26 Aug. 1976 148 p
(AD-A035505; AFGL-IP-249; AFGL-TR-76-0195) Avail: NTIS HC A07/MF A01 CSCL 01/3

Six computer programs were developed to provide both standardized methods for solution of typical tethered-balloon performance problems and improved techniques sufficient to study the very high altitude tethered-balloon system design problem. The programs are written for an HP-9810 A desk computer but are fully documented for conversion to other types of equipment. Preliminary results are shown indicating the feasibility of a balloon tethered at an altitude of 20 km. GRA

N77-26086# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Aeroballistics Directorate.
THE AERODYNAMIC CHARACTERISTICS OF WRAP-AROUND FINS AT MACH NUMBERS OF 0.3 TO 3.0
C. Wayne Dahlke 15 Oct. 1976 62 p refs

(AD-A036715; RD-77-4) Avail: NTIS HC A04/MF A01 CSCL 19/7

Results of investigations into many of the geometric and flow parameters influencing the aerodynamics of wrap-around fins are presented in this report. Particular emphasis is placed on defining static and dynamic roll characteristics between Mach numbers of 0.3 to 3.0. Among the geometric parameters highlighted are fin span, aspect ratio, leading edge sweep, leading edge shape, fin opening angle, and afterbody geometry. Comparisons of static stability, dynamic stability, and drag are made between the flat and the wrap-around fin. Problems associated with measurement of wrap-around fin rolling mounts are also discussed. An overview of the wrap-around fin roll moment characteristics are presented as an aid for making estimates and establishing testing techniques. This report supercedes RD-73-17. Author (GRA)

N77-26087# Sandia Labs., Albuquerque, N. Mex. Parachute Systems Div.

DOCUMENTATION OF THE FEASIBILITY RESEARCH ON A DESTRUCTIBLE PARACHUTE

William B. Pepper and Robert J. Buxton Nov. 1976 36 p refs

(Contract E(29-1)-789)

(SAND-76-0111) Avail: NTIS HC A03/MF A01

A destructible parachute capable of deceleration, ignition, and disintegration during free flight was developed. Because of the limited time available for the investigation, a standard nylon ribbon parachute was used with a unique pyrotechnic material to disintegrate the nylon. The most reactive pyrotechnic consisted of a mixture of fine particle metal powders, TNT, and an elastomer, such as Viton A. The materials used in the pyrotechnic mixture and the impregnating procedure are discussed. The pyrotechnic impregnated parachute fabric testing, parachute packaging and flight delivery of experimental payloads at Tonopah Test Range established the feasibility that a sensor can be delivered without detection. ERA

N77-26088# Laboratoire d'Aerothermique du C.N.R.S., Meudon (France).

THE PROBLEM OF A BLUNT BODY IN A RAREFIED SUPERSONIC FLOW [LE PROBLEME DU CORPS EMOUSSE DANS UN ECOULEMENT SUPERSONIQUE RAREFIE]

J. C. Lengrand Oct. 1975 62 p refs In FRENCH; ENGLISH summary

(Rept-75-3) Avail: NTIS HC A04/MF A01

Density and rotational temperature were measured within the flow field around blunt bodies in a rarefied supersonic flow. New and previous data on shock stand-off distance and shock thickness were found to be well correlated when using a modified Reynolds number. For a given shape of the body, the obtained correlations are independent of wall temperature, Mach number, and gas nature. Based on this modified Reynolds number, a classification of the different rarefaction regimes is proposed which generalizes the previous classification. Author (ESA)

N77-26089# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge-Entwicklung.

UNSTEADY TWO-DIMENSIONAL WING FLOW AT LARGE CONTROL SURFACE ANGLES M.S. Thesis - Tech. Univ. Munich

Wilfrid Camen 14 Mar. 1975 70 p refs In GERMAN; ENGLISH summary

(MBB-UFE-1183(O)) Copyright. Avail: NTIS HC A04/MF A01

A solution method was developed and programmed for the unsteady two-dimensional flow around wings with control surfaces at large angles. The pressure distributions, lift, and moment coefficients due to control surface and/or leading-edge flap oscillations at various frequencies were investigated for a number of stationary angles of attack between 0 and 90 deg. It was found that the mean control surface angle, around which the control surface oscillates on a small scale, affects the unsteady aerodynamic forces. In case of a control surface oscillation, the unsteady aerodynamic forces increase with the mean control surface angle. The singularity at the leading edge of the control surface, varies with the mean control and surface angle. Author (ESA)

N77-26090# Oxford Univ. (England). Dept. of Engineering Science.

THE ENERGY BALANCE IN A VORTEX TRAIL

M. E. Greenway and C. J. Wood Oct. 1976 51 p refs

(OUEL-1162/76) Avail: NTIS HC A04/MF A01

An attempt is made to show, by means of a partial and very approximate analysis, that the energy balance is capable of providing one more relationship linking vortex trails with the bodies that cause them. This consideration is especially important in connection with vibrating bodies which may be subject to excitation or damping due to the flow. A small amount of experimental data is compared qualitatively with the predicted relationship. Additional experimental evidence is expected shortly which may provide guidance for a further refinement of the analysis. Author (ESA)

N77-26091# European Space Agency, Paris (France).

ADVANCEMENT OF A METHOD FOR CALCULATING SEPARATED FLOWS AROUND AIRFOILS WITH SPECIAL CONSIDERATION OF PROFILE DRAG

Klaus Jacob Apr. 1977 56 p refs Transl. into ENGLISH of 'Weiterentwicklung eines Verfahrens zur Berechnung der abgeloesten Profilstroemung mit besonderer Beruecksichtigung des Profilwiderstandes', DFVLR, Goettingen, West Ger. Report DLR-FB-76-36, 6 Aug. 1976 Original report in GERMAN previously announced as N77-20037 Original German report available from DFVLR, Cologne DM 33,80

(ESA-TT-373; DLR-FB-76-36) Avail: NTIS HC A04/MF A01

A previously developed numerical method for theoretical prediction of airfoil lift in incompressible flow with rear separation is discussed. In this method the dead air region is simulated by an outflow region and the point of separation is determined iteratively by combining potential flow and boundary layer calculations. This method has been improved and extended within the last few years and gives pressure distributions and lift coefficients, which mostly agree well with experiments. If, however, the method is applied in present form to the calculation of profile drag, the calculated pressure drag is too small. The reason for this was investigated and a better drag prediction achieved by further improvement of the method. Author (ESA)

N77-26092# European Space Agency, Paris (France).

NUMERICAL INTEGRATION OF THE GOVERNING EQUATIONS FOR THE DOMAIN OF PURE SUPERSONIC FLOWS

Claus Weiland May 1977 48 p refs Transl. into ENGLISH of 'Numerische Integration der Bewegungsgleichungen fuer den Bereich reiner Ueberschallstroemungen', DFVLR, Cologne Report DLR-FB-76-65, 7 Dec. 1976 Original report in GERMAN previously announced as N77-25106 Original German report available from DVLR, Cologne DM 19,60

(ESA-TT-380; DLR-FB-76-65) Avail: NTIS HC A03/MF A01

Three-dimensional steady inviscid flow fields arising at pointed or blunted bodies at supersonic freestream Mach numbers were calculated. The gasdynamic equations of motion were integrated by means of a finite difference procedure. Since this procedure is also to be applied to relative low supersonic freestream Mach numbers and angles of attack between 0 and 30 deg the system of equations is retained hyperbolic in marching direction by a special coordinate transformation. Shock waves embedded in the flow field can be calculated by introduction of artificial dissipative terms altough the governing equations are discretized in the nonconservative form. Results of sample calculations are in good agreement with experimental data for angles of attack less than 10 deg. Author (ESA)

N77-26093# Army Missile Research and Development Command, Redstone Arsenal, Ala. Aeroballistics Directorate.

AN EXPERIMENTAL INVESTIGATION USING A NORMAL JET PLUME SIMULATOR TO DETERMINE JET PLUME EFFECTS ON A LONG SLENDER ROCKET CONFIGURATION AT MACH NUMBERS FROM 0.2 TO 1.5

J. H. Henderson, C. W. Dahlke, and G. Batiuk 4 Feb. 1977 147 p refs

(DA Proj. 1W3-62303-A-214)

(AD-A037735; DRDMI-TD-77-2) Avail: NTIS HC A07/MF A01 CSCL 20/4

Experimental aerodynamic investigations were conducted at the AEDC 16-foot Transonic Wind Tunnel to determine longitudinal stability characteristics of a long slender rocket configuration with simulated jet plume. The effect of jet plume on rocket aerodynamics is given over an angle of attack range from -11 to 11 deg at Mach numbers from 0.2 to 1.5. Plume simulator chamber pressure varied from 0 to 600 psia. Individual cruciform fin aerodynamic loads are also shown over the same ranges. Author (GRA)

N77-26094# Raven Industries, Inc., Sioux Falls, S. Dak. Flight Operations Dept.

SKYHOOK 1976 Interim Report, 30 Jan. 1976 - 30 Jan. 1977

Tom Pappas 30 Jan. 1977 115 p

(Contract N00014-76-C-0731)

(AD-A037419; R-1276007) Avail: NTIS HC A06/MF A01 CSCL 01/2

The 1976 Skyhook program provided sufficient funding and balloons for an attempted twelve flights from the Sioux Falls, S. D. and Watertown, S. D. areas. Eight flights were successfully launched, but a telemetry transmitter failed on one, reducing scientific exposure to seven flights. These seven flights provided over 196 hours at float altitude for the various experiments. This report describes individual flights, equipment used, flight data, and other program information. Author (GRA)

N77-26095# Naval Ship Research and Development Center, Bethesda, Md. Ship Performance Dept.

A NONLINEAR VERTICAL-PLANE MATHEMATICAL MODEL FOR AIR CUSHION-SUPPORTED VEHICLES

David D. Moran Jun. 1976 59 p refs

(AD-A037062; SPD-615-05) Avail: NTIS HC A04/MF A01 CSCL 01/3

An analytical model for predicting the pitch and heave response of air-cushion-supported vehicles (ACV) during overland operation is developed. The effects of air compressibility and skirt contact with the supporting surface are included in the model. The resulting analytical model is used to predict the response of a JEFF (B) experimental model to periodically varying terrain. These predictions show excellent correlation with experimental model data, thereby serving as verification of the accuracy of the analytical model for a complete range of operating conditions for the JEFF (B). Author (GRA)

N77-26096# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.

DETERMINATION OF THE AIRWORTHINESS OF ZPG-3W COTTON D621 AND THE ZPG-2 DACRON GDC-5 AIRSHIP ENVELOPES Final Report

E. Th. Vadala 31 Jan. 1977 45 p refs

(AD-A037548; NADC-76322-30) Avail: NTIS HC A03/MF A01 CSCL 01/3

Two nonrigid airship envelopes were removed from storage and the envelopes were inspected to determine their suitability for further flight service. The ZPG-3W envelope was found to be extensively damaged due to conditions under which it was stored. It was judged irrepairable and was scrapped. The ZPG-2 envelope was in good condition generally. The envelope was considered to be suitable for further flight service when reinforcement of the upper surface was accomplished. GRA

N77-26097# Ballistic Research Labs., Aberdeen Proving Ground, Md.

WIND TUNNEL TESTS OF SUPERSONIC LIFTING BODIES AT MACH NUMBER 1.5 TO 4.0 Final Report

Charles R. Nietubicz Feb. 1977 55 p

(DA Proj. 1T6-62618-AH-80)

(AD-A037380; BRL-MR-2728) Avail: NTIS MF A01 CSCL 01/3

Wind tunnel tests were conducted on four new wedge shaped configurations, one of which approached that of a wave rider design. Aerodynamic data are presented for Mach numbers 1.5 through 4.0 with angle of attack variation from -10 to +7 deg. The data are similar to previously reported results with the one exception being the near wave rider configuration. This configuration resulted in lift/drag data being invariant with respect to Mach number. The maximum value of lift/drag reached approximately 3.0. Author (GRA)

N77-26098# Air Force Geophysics Lab., Hanscom AFB, Mass.

THE FLIGHT TEST ASPECTS OF THE AIR-LAUNCHED BALLOON SYSTEM (ALBS) DEVELOPMENT PROGRAM Scientific Interim Report, Jul. 1975 - Jul. 1976

Andrew S. Carten, Jr. 25 Aug. 1976 82 p refs

(AD-A037540; AFGL-TR-76-0196; AFGL-IP-250) Avail: NTIS HC A05/MF A01 CSCL 01/3

The Air Launched Balloon System (ALBS) development history is traced and the circumstances leading up to planned ALBS flight tests are described, including a report on successful tests of the cryogenic storage subsystem. The theoretical performance of a candidate parachute development system--35-ft (10.67 m) diameter ring sail drogue, 64-ft (19.51 m) diameter flat circular main chute--is mathematically analyzed using a number of stated assumptions. Contingency arrangements (e.g., use of ballast) and their impact are discussed. Data indicate that the ALBS mid-air deployment concepts require experimental proof-of-concept testing to ensure optimum component selection. Parachute subsystem verification tests planned for the autumn of 1976 at El Centro, Calif., are outlined along with plans for partial and complete ALBS system test drops from a carrier balloon in 1977 at White Sands Missile Range. GRA

N77-26099# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.

OPTIMUM DESIGN OF COMPOSITE WING STRUCTURES WITH TWIST CONSTRAINT FOR AEROELASTIC TAILORING Final Report, Jun. 1975 - Jun. 1976

N. S. Khot, V. B. Venkayya, L. Berke, and K. Schrader Dec. 1976 47 p refs

(AD-A038029; AFFDL-TR-76-117) Avail: NTIS HC A03/MF A01 CSCL 01/3

The objective of this effort was to develop a method to design a minimum weight, fiber reinforced, composite wing structure with a specific twist constraint. Designing a wing for the desired twist is one of the main objectives in the concept of aeroelastic tailoring. The structure is analyzed by a finite element method and the design variables are modified by using a recurrence relation based on an optimality criteria. To demonstrate the method, a wing structure is designed to have a specific negative or positive twist corresponding to 'wash out' and 'wash in' conditions. The designs satisfy the twist constraint and the strength criteria in all elements. Author (GRA)

N77-26100# Auburn Univ., Ala. Dept. of Aerospace Engineering.

AERODYNAMIC INTERFERENCE OF TWO AXISYMMETRIC STORES AT LOW SUPERSONIC SPEEDS Final Report, Sep. 1975 - Sep. 1976

John E. Burkhalter and Fred W. Martin Oct. 1976 66 p refs

(Contract F08635-C-0079)

(AD-A036900; AFATL-TR-76-116) Avail: NTIS HC A04/MF A01 CSCL 20/4

A method for determining the basic pressure distribution on an axisymmetric body in supersonic flow has been evaluated. Supersonic line sources with linearly varying strengths placed along the centerline of the body were used to generate the body shape. The results of these theoretical computations for an isolated body agreed very well with experimental data. Two approaches were investigated to determine the pressure distribution on two bodies interfering with each other. In the first approach supersonic point sources were placed along an image line, as determined by subsonic theory, and along the body centerline. The strengths of these point sources were determined so that body boundary conditions were met on top and bottom of each interfering body. Computational problems were encountered with this technique resulting from the nature of induced velocities from a supersonic point source and the approach was finally abandoned. The second interference approach utilized linearly varying line sources placed along an image line and along the body centerline. The location of the image line is solely a function of the delta-x interval chosen for the problem. As before, body boundary conditions were met on top and on

bottom of each interfering body. The results of these computations appear realistic for thin bodies. GRA

N77-26101# Texas A&M Univ., College Station.
AN EXPERIMENTAL INVESTIGATION OF INCOMPRESSIBLE FLOW OVER DELTA AND DOUBLE-DELTA WINGS Technical Report, 1 Jan. - 31 Dec. 1976
James K. Nathman, David J. Norton, and Balusu M. Rao Dec. 1976 80 p refs
(Contract N00014-75-C-0255)
(AD-A035380; ONR-CR215-231-3) Avail: NTIS HC A05/MF A01 CSCL 20/4

An experimental study of the flow over delta and double-delta wings was conducted in a 7' x 10' low speed wind tunnel. The configurations tested were AR-3 and AR-4 delta wings and the AR-4 wing which was modified with AR-1 and AR-2 strakes attached to form double-delta wings. Pressure measurements, surface flow visualization, and vortex core visualization studies were conducted over a wide range of angles of attack. GRA

N77-26102# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
CONTROL OF A GLIDING PARACHUTE SYSTEM IN A NON-UNIFORM WIND Technical Report, Jan. - Dec. 1975
Allan E. Pearson and Kuang-Chung Wei May 1976 54 p refs
(Contract DAAG17-73-C-0172; DA Proj. 1F2-62203-AH-86)
(AD-A036076; NARADCOM-TR-76-60-AMEL) Avail: NTIS HC A04/MF A01 CSCL 01/3

This report investigates a method for post deployment guiding of a cargo-carrying gliding parachute to a target. Least squares estimation and an open-loop control law based on geometric considerations are combined to define a closed-loop control law for the system under variable wind conditions. Simulation studies of the overall system are included for a variety of initial conditions and wind profiles. These simulations indicate that the proposed algorithm, with additional experimentation, may be a feasible solution to the problem. Author (GRA)

N77-26103# Calspan Corp., Buffalo, N.Y.
WIND TUNNEL WALL EFFECTS Final Report, 15 Nov. 1971 - 30 Sep. 1976
John C. Erickson, Jr. and Robert J. Vidal 30 Sep. 1976 9 p refs
(Contract N00014-72-C-0102)
(AD-A037532) Avail: NTIS HC A02/MF A01 CSCL 14/2

This document summarizes a study of work done on the concept of a self-correcting wind tunnel, i.e., one which uses active control of the flow by the walls in conjunction with functional relationships among measured flow disturbance quantities to insure that unconfined-flow conditions exist in the test section, as applied to the concept to a two-dimensional transonic wind tunnel. GRA

N77-26104# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
THE INITIAL ROLL-UP OF A THICK, TWO-DIMENSIONAL WAKE BEHIND A WING OF FINITE SPAN Interim Report
H. Portnoy 1976 11 p refs
(Grant AF-AFOSR-2145-71; AF Proj. 9781)
(AD-A037033; TAE-328; AFOSR-TR-77-0098) Avail: NTIS HC A02/MF A01 CSCL 20/4

This work is an attempt to remove the unrealistic features of earlier vortex wake models, namely zero wake thickness and vorticity concentrated on lines, by assuming that the wake vorticity is contained in a layer of finite thickness with some plausible cross-sectional shape. The wake flow is assumed to be two-dimensional and the rolling-up is studied via the time-dependent development of this model so that it deals with the slow rolling-up taking place far behind the wing. The mathematical model of the wake is described and examples of the initial roll-up phase have been calculated for three wakes of different thicknesses and elliptic cross-sections, subjected to uniform downwash (corresponding to elliptic spanwise loading). Author (GRA)

N77-26105# Tel-Aviv Univ. (Israel). Dept. of Mathematical Sciences.
THE NUMERICAL COMPUTATIONS OF SUPERSONIC FLOW PAST BLUNT BODIES Interim Report
Saul S. Abarbanel 1976 52 p refs
(Grant AF-AFOSR-2370-72; AF Proj. 9781)
(AD-A037665; AFOSR-77-0162TR) Avail: NTIS HC A04/MF A01 CSCL 20/4

Methods for computing numerically the flow past blunted bodies travelling at supersonic speed are developed, using finite difference schemes. The algorithms were constructed to deal with 2-D axisymmetric and 3-D configurations. Various configurations were investigated and the flow field around them computed. Comparison with available semi-empirical results for blunted cones at Mach number 3 shows good agreement. The 3-D algorithm was applied to an axisymmetric configuration and the results thus obtained show good agreement with the axisymmetric calculation. All the calculations are for the inviscid gas-dynamic case. Author (GRA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N77-26106*# Science Applications, Inc., Los Angeles, Calif. Economic Analysis Div.
PARAMETRIC STUDY OF TRANSPORT AIRCRAFT SYSTEMS COST AND WEIGHT
Michael N. Beltramo, Donald L. Trapp, Bruce W. Kimoto (Douglas Aircraft Co.), and Daniel P. Marsh (Douglas Aircraft Co.) Apr. 1977 288 p refs
(Contract NAS2-8703)
(NASA-CR-151970) Avail: NTIS HC A13/MF A01 CSCL 01C

The results of a NASA study to develop production cost estimating relationships (CERs) and weight estimating relationships (WERs) for commercial and military transport aircraft at the system level are presented. The systems considered correspond to the standard weight groups defined in Military Standard 1374 and are listed. These systems make up a complete aircraft exclusive of engines. The CER for each system (or CERs in several cases) utilize weight as the key parameter. Weights may be determined from detailed weight statements, if available, or by using the WERs developed, which are based on technical and performance characteristics generally available during preliminary design. The CERs that were developed provide a very useful tool for making preliminary estimates of the production cost of an aircraft. Likewise, the WERs provide a very useful tool for making preliminary estimates of the weight of aircraft based on conceptual design information. Author

N77-26107# Committee on Commerce (U. S. Senate).
OVERSIGHT HEARINGS ON THE SST
Washington GPO 1976 137 p refs Hearing before Comm. on Commerce, 94th Congr., 2d Sess., 20 Feb. 1976
(GPO-76-492) Avail: Comm. on Commerce

The decision to allow the Concorde supersonic transport aircraft to fly to the United States is reviewed. Factors considered include noise, ozone depletion, and fuel conservation. Protection of the environment is emphasized. J.M.S.

N77-26108*# Aerospace Corp., El Segundo, Calif.
A STUDY OF COMMUTER AIR SERVICE
F. W. Belina and L. R. Bush Jun. 1977 100 p refs
(Contract NAS2-9380)
(NASA-CR-152005) Avail: NTIS HC A05/MF A01 CSCL 01C

A regionally oriented overview of the commuter air service industry is provided. A framework for an eventual assessment of potential technology directions that may be of benefit to the industry is presented. Data are provided on the industry's market characteristics, service patterns, patronage characteristics, aircraft and airport needs, economic characteristics and institutional issues. Using personal interview and literature survey methods, investiga-

tion of a considerable cross-section of the industry was made.
Author

N77-26109# Mitre Corp., McLean, Va.
ESTIMATION OF UG3RD SAFETY BENEFITS Final Report
T. R. Simpson, A. P. Smith, and J. S. Matney Jan. 1977 79 p refs
(Contract DOT-FA70WA-2448)
(AD-A036895; FAA-AVP-77-8) Avail: NTIS HC A05/MF A01 CSCL 01/2

This study estimates the value of aviation safety improvements that could be obtained by implementing various alternative configurations of the Upgraded Third Generation ATC System. Estimates are based on the central assumption that the frequency of aviation accidents per operation observed in the past will be repeated unless identifiable steps are undertaken to eliminate specific classes of accidents. Recent accident data on midair collisions and controlled collisions with the terrain were examined to identify types of accidents that could be prevented by the UG3RD. Preventable accident rates were calculated and used to forecast future accidents under an extension of today's system and accidents that could be prevented by the UG3RD.
Author (GRA)

N77-26110# National Transportation Safety Board, Washington, D. C. Bureau of Technology.
ANNUAL REVIEW OF AIRCRAFT ACCIDENT DATA, US AIR CARRIER OPERATIONS, 1975
25 Jan. 1977 98 p
(PB-264346/8; NTSB-ARC-77-1) Avail: NTIS HC A05/MF A01 CSCL 01B

The record of aviation accidents which occurred in all opearations of the U.S. air carriers for calendar year 1975 is presented. An analysis by class of carrier and type of service in which the 1975 performances were compared with 5-year base-period averages is included. All scheduled services of the certified route carriers for the past 5 years (1971 through 1975) were compared with the previous 5-year period (1966 through 1970) for types of accidents and phases of operation. Statistical tables, which summarize the accidents, fatalities, and accident rates; causal tables; and briefs of accidents are presented in the appendixes.
GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N77-26111*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FLIGHT TEST RESULTS OF THE STRAPDOWN HEXAD INERTIAL REFERENCE UNIT (SIRU). VOLUME 1: FLIGHT TEST SUMMARY
Ronald J. Hruby and William S. Bjorkman (Analytical Mechanics Assoc., Inc., Mountain View, Calif.) Jun. 1977 27 p refs
(NASA-TM-73163; A-6924) Avail: NTIS HC A03/MF A01 CSCL 17G

Flight test results of the strapdown inertial reference unit (SIRU) navigation system are presented. The fault-tolerant SIRU navigation system features a redundant inertial sensor unit and dual computers. System software provides for detection and isolation of inertial sensor failures and continued operation in the event of failures. Flight test results include assessments of the system's navigational performance and fault tolerance.
Author

N77-26112*# Ohio Univ., Athens. Avionics Engineering Center.
A FOUR DIGIT MEMORY-MAPPED DISPLAY
Ralph E. Smith May 1977 10 p
(Grant NGR-36-009-017)
(NASA-CR-153265; TM-51) Avail: NTIS HC A02/MF A01 CSCL 17G

A circuit for interfacing the JOLT (TM) microprocessor to four digital displays was designed and fabricated. Circuit operation and test program are described and presented in detail.
B.B.

N77-26113# Naval Weapons Support Center, Crane, Ind. Applied Sciences Dept.
FLIGHT TEST EVALUATION OF SLANT VISUAL RANGE/ APPROACH LIGHT CONTACT HEIGHT (SVR/ALCH) MEASUREMENT SYSTEM Final Report
G. S. Bradley, L. W. Lohkamp, and R. W. Williams Nov. 1976 64 p
(Contract DOT-FAWI-213)
(AD-A038183/0; FAA-RD-76-167) Avail: NTIS HC A04/MF A01 CSCL 01/5

The Slant Visual Range/Approach Light Contact Height (SVR/ALCH) System reports the slant visual range that is seen when the pilot is at 100 feet above ground level and the approach light contact height, which is the altitude at which a pilot will see five light bars, as a landing is conducted. The SVR/ALCH system was evaluated in terms of accuracy of the SVR and ALCH algorithms compared to what a pilot actually sees during an approach. From the limited data obtained to date, there is evidence that the algorithms predict SVR and ALCH values which agree reasonably well with what the pilot sees.
Author

N77-26114# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DABS MONOPULSE SUMMARY Summary Report
D. Karp and M. L. Wood 4 Feb. 1977 102 p refs
(Contracts DOT-FA72WAI-261; F19628-76-C-0002)
(AD-A038157/4; ATC-72; FAA-RD-76-219) Avail: NTIS HC A06/MF A01 CSCL 17/7

Improved azimuthal resolution of proximate aircraft necessary to support ATC automation can be achieved by beacon surveillance systems employing monopulse angle estimation techniques. Topics discussed include: beacon surveillance monopulse system analyses relating to off boresight angle estimation using short (1/2 sec) pulses; the effects of specular and diffuse multipath signal return; the effects of overlapping ATCRBS fruit replies; and problems of antenna pattern design for the discrete address beacon system (DABS).
Author

N77-26115# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md. Dept. of Fleet Systems.
SYSTEM DEFINITION AND INVESTIGATION OF THE ON SITE PROCESSING OF EN ROUTE SENSOR SIGNALS. VOLUME 1: SUMMARY OF RESULTS, SYSTEM DEFINITION, RADAR PROCESSING Final Report, Sep. 1974 - Sep. 1976
J. W. Thomas, E. C. Wetzler, and L. H. Zitzman Sep. 1976 291 p refs 3 Vol.
(Contract DOT-FA75WA-3553)
(AD-A038491/7; FP8-E-024-Vol-1; FAA-RD-77-12-Vol-1) Avail: NTIS HC A13/MF A01 CSCL 17/7

Requirements from the primary radar system and from the air traffic control radar beacon system (ATCRBS) for the en route automation portion of the National Airspace System were defined and a system devised for unloading the data line from the on-site surveillance system. Analytical and empirical studies determined the requirements placed on the common digitizer (CD) by the Air Route Traffic Control Center's central computer complex, the processing capabilities and limitations of the CD, and the requirements the CD places on the surveillance sensors. A summary of major results, conclusions, and recommendations for the entire program is given. The work accomplished and results obtained in the area of primary radar processing are described, and the ATCRBS jitter problem is discussed from the overall surveillance system standpoint.
Author

N77-26116# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md. Dept. of Fleet Systems.
SYSTEM DEFINITION AND INVESTIGATION OF THE ON SITE PROCESSING OF EN ROUTE SENSOR SIGNALS. VOLUME 2: BEACON PROCESSING INVESTIGATION Final Report, Sep. 1974 - Sep. 1976
J. W. Thomas Sep. 1976 210 p Original contains color

illustrations 3 Vol.
(Contract DOT-FA75WA-3553)
(AD-A038492/5; FP8-E-024-Vol-2; FAA-RD-77-12-Vol-2) Avail: NTIS HC A10/MF A01 CSCL 17/7

The processing of Air Traffic Control Radar Beacon Systems (ATCRBS) secondary radar information within the common digitizer is discussed. Author

N77-26117# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md. Dept. of Fleet Systems.
SYSTEM DEFINITION AND INVESTIGATION OF THE ON SITE PROCESSING OF EN ROUTE SENSOR SIGNALS. VOLUME 3: APPENDICES Final Report, Sep. 1974 - Sep. 1976
E. C. Wetzlar and L. H. Zitzman Sep. 1976 109 p 3 Vol.
(Contract DOT-FA75WA-3553)
(AD-A038493/3; FP8-E-024-Vol-3; FAA-RD-77-12-Vol-3) Avail: NTIS HC A06/MF A01 CSCL 17/7

Backup data are presented to support documents N77-26115 and N77-26116.

N77-26118# Human Engineering Labs., Aberdeen Proving Ground, Md.
PILOTAGE NAVIGATION UTILIZING A NIGHT-VISION SYSTEM
Neil A. Johnson and Murray Foster, Jr. Feb. 1977 21 p refs
(AD-A036774; HEL-TM-6-77) Avail: NTIS HC A02/MF A01 CSCL 17/8

A field test was conducted to evaluate pilotage-navigation performance using a forward-looking infrared (FLIR) night-vision system. Two types of displays (helmet-mounted and panel-mounted) were used, each with three fields of view (FOV) (narrow, 15 deg vertical x 20 deg horizontal; medium, 30 deg vertical x 40 deg horizontal; wide, 45 deg vertical x 60 deg horizontal). The results indicate that the wide FOV is more effective than either of the narrower FOV's. The future TADS system is proposed to have a horizontal FOV on the order of 40 deg; the authors believe this will present serious problems in conducting pilotage navigation. The implications of these results are discussed.
Author (GRA)

N77-26119# Administrative Sciences Corp., Alexandria, Va.
AN ECONOMETRIC ANALYSIS OF ENROUTE AND TERMINAL AIR TRAFFIC CONTROL Final Report, 31 Dec. 1975 - 30 Jun. 1976
Henry L. Eskew, Thomas P. Frazier, and Beatrice M. Smith 30 Jun. 1976 81 p refs Prepared for Noah (J. Watson) Associates, Inc., Falls Church, Va.
(Contract DOT-FA76WA-3769)
(AD-A036892; ASC-R-110; FAA-AVP-77-1) Avail: NTIS CSCL 17/7

This study was undertaken in connection with a comprehensive evaluation of proposed new investments in the upgraded Third Generation Air Traffic Control System. It involved a quantitative analysis of the relationship between ATC system outputs and inputs. Outputs are defined in terms of operations handled while inputs consist of labor and capital. Separate production functions were estimated for enroute (ARTCC) and terminal (tower) control operations. In each case, two different sets of data were used. One consisted of a cross-section of observations on individual facilities in a single year. The other was a time series of annual observations on that portion of the system taken as a whole. Following development of the production functions, an optimality analysis was conducted. Estimates of the unit cost of labor and capital were developed. These were combined, via a mathematical optimization procedure, with the preferred production functions to compute least-cost combinations of labor and capital for various levels of ATC service demand. The results indicate that, for both centers and towers, substantial additions to the net capital stock will be required over the years to come if expansion of the system (to meet growing service demand) is to be economically efficient. Author (GRA)

N77-26120# Facility Checking Squadron (1866th) (AFCS), Richards-Gebaur AFB, Mo.
COMMUNICATIONS STATION EVALUATION REPORT, SELFRIDGE ANGB, MICHIGAN, 9-18 NOVEMBER 1976 Final Report
Jimmy D. Buford 22 Feb. 1977 70 p refs
(AD-A037479; Rept-76/66C-83) Avail: NTIS HC A04/MF A01 CSCL 17/7

Traffic Control and Landing Systems (TRACALS) Communications Station Evaluation was performed at Selfridge ANGB, Michigan (2031 Comm Sq) from 9 Nov through 18 Nov 1976. The purpose of the evaluation was to define the capabilities and limitations of the air traffic control VHF/UHF communications systems. Included in this report are results and analysis of equipment checks, loop test line level diagrams for the RAPCON and control tower systems, line of sight coverage data, analysis of airborne measurements, and plots of UHF radiation patterns. The data and diagrams in this report can be used as guides for anticipated performance of the communications system at Selfridge ANGB until there is an addition, deletion, relocation of equipment, or change in horizon profile which would affect the system. The principles presented are valid for other locations using the same communications equipment. Author (GRA)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N77-26121*# Boeing Vertol Co., Philadelphia, Pa.
RESEARCH REQUIREMENTS FOR DEVELOPMENT OF IMPROVED HELICOPTER ROTOR EFFICIENCY
S. Jon Davis Dec. 1976 58 p refs
(Contract NAS1-13624)
(NASA-CR-145117) Avail: NTIS HC A04/MF A01 CSCL 01C

The research requirements for developing an improved-efficiency rotor for a civil helicopter are documented. The various design parameters affecting the hover and cruise efficiency of a rotor are surveyed, and the parameters capable of producing the greatest potential improvement are identified. Research and development programs to achieve these improvements are defined, and estimated costs and schedules are presented. Interaction of the improved efficiency rotor with other technological goals for an advanced civil helicopter is noted, including its impact on engine noise, hover and cruise performance, one-engine-inoperative hover capability, and maintenance and reliability.
Author

N77-26122*# Kansas Univ. Center for Research, Inc., Lawrence.
FLIGHT TEST DATA FOR LIGHT AIRCRAFT SPOILER ROLL CONTROL SYSTEMS
David L. Kohlman 1977 28 p refs Presented at the Business Aircraft Meeting, Century II, Wichita, Kansas, 29 Mar. - 1 Apr. 1977
(Grants NGR-17-002-072; NsG-1227)
(NASA-CR-153291; Rept-770441) Avail: NTIS HC A03/MF A01 CSCL 01C

The results of flight tests to determine the characteristics of spoiler roll control systems on three different light aircraft are summarized. Comparisons are made with wind tunnel data where available. Flight tests indicate that excellent roll characteristics can be achieved with spoilers. Yaw coupling with roll control inputs is virtually eliminated. Roll rates remain high when flaps are deployed at low speed. Very mild nonlinearities in control effectiveness exist, and there was no deadband or lag detected.
Author

N77-26123# Hughes Helicopters, Culver City, Calif.
EROSION PROTECTION FOR THE AH-1 G LOW RADAR CROSS-SECTION MAIN ROTOR BLADE. VOLUME 1: SAND AND RAIN EROSION EVALUATION Final Report, Nov. 1975 - Nov. 1976
Robert E. Head Jan. 1977 62 p ref
(Contract DAAJ02-76-C-0008)
(AD-A035961; HH-76-191-Vol-1; USAARMDL-TR-76-40A-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 01/3

The purpose of this program was to design, fabricate, and test components for the composite nonmetal Multi-Tubular Spar MTS main rotor blade for the AH-1 G helicopter that would give good erosion protection in sand and rain environments, and have a low radar cross section. The report on this program is divided into two volumes: the first deals with erosion protection, and the second covers radar cross section. In this volume, Volume I, a screening process narrowed fifteen candidate erosion materials to two. These were subjected to MIL-SPEC sand and rain environments, which encompassed specified sand-particle and rain-droplet-size populations. Test conditions simulated an AH-1 G rotor flying at 125 knots in a 1.89 inch-per-hour rain (959 fps tip speed) and the rotor hovering in ground effect (7506en1] fps tip speed) in the sand cloud it blows up. The tests demonstrated that a 0.025-inch-thick polyurethane material gave the best protection and was easiest to apply and remove for replacement. Author (GRA)

N77-26124# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge-Entwicklung.

AN EXACT HODOGRAPH METHOD FOR THE DESIGN OF SUPERCRITICAL AIRFOILS

Albrecht Eberle 15 Apr. 1975 178 p In GERMAN; ENGLISH summary

(MBB-UFE-1168(O)) Avail: NTIS HC A09/MF A01

The theoretical and numerical treatment of an exact method for the design of transonic airfoils is described. The physical plane is mapped into a working plane by using some transformations linearizing the gas dynamic equation. The subsonic part of the flow problem is solved by a two-dimensional panel method using Green's formula, whereas a simple method of characteristics solves the supersonic part of the problem. Author (ESA)

N77-26125# Naval Postgraduate School, Monterey, Calif.

A COMPARISON OF THE USAF PROJECTED A-10 EMPLOYMENT IN EUROPE AND THE LUFTWAFFE SCHLACHTGESCHWADER EXPERIENCE ON THE EASTERN FRONT IN WORLD WAR II M.S. Thesis

Lonnie Otis Ratley, III Mar. 1977 215 p refs

(AD-A036863; NPS-56SK77011) Avail: NTIS HC A10/MF A01 CSCL 01/3

This study was conducted to analyze the methods, successes, failures, and operational performance of the German Luftwaffe anti-tank aircraft and units in World War II on the eastern front, and the possible application of the Luftwaffe experience to the current NATO air forces. The research involved interviews with former Luftwaffe officers who participated in the German eastern campaign from 1941-45, a trip to the Bundesarchiv-Militaerarchiv in Freiburg, West Germany, a trip to the Air University Library, Maxwell AFB, Alabama, in addition to participation in an anti-tank seminar held in Washington, D. C., on 14-15 October 1976. The results of the study indicate considerable applicability of the Luftwaffe experience in World War II on the eastern front in anti-tank operations to the current military situation in Europe. The USAF A-10 aircraft, based on the cited historical example, appears to have considerable potential for use as an airborne anti-tank platform in combating the massive Warsaw Pact armored strength. Author (GRA)

N77-26126# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.

FATIGUE INVESTIGATION OF THE C-2A NOSE LANDING GEAR Final Report

H. D. Lystad 14 Oct. 1976 38 p refs

(AD-A037901; NADC-76235-30) Avail: NTIS HC A03/MF A01 CSCL 01/3

A laboratory fatigue investigation was performed on a C-2A nose landing gear to determine whether the authorized limit of 900 catapult launches could be extended. During the application of test cycle 1,260, the shock strut outer cylinder failed. Using a test scatter factor of two; this is equivalent to 630 service catapult launches. Combined with the estimated 310 in-service catapult launches of the test specimen, this indicates no allowable increase in the C-2A nose landing gear service life.

Author (GRA)

N77-26127# Douglas Aircraft Co., Inc., Long Beach, Calif.

EFFECTS OF LABORATORY SIMULATED PRECIPITATION STATIC ELECTRICITY AND SWEPT STROKE LIGHTNING ON AIRCRAFT WINDSHIELD SUBSYSTEMS Final Report, Nov. 1975 - May 1976

R. C. Twomey Wright-Patterson AFB, Ohio AFFDL Jul. 1976 160 p refs

(Contract F33615-75-C-3105)

(AD-A037196; MDC-J6952; AFFDL-TR-76-75) Avail: NTIS HC A08/MF A01 CSCL 01/3

Candidate outer ply materials for aircraft windshields subjected to laboratory simulated static electric charging and swept stroke lightning tests are evaluated. Very high values of static charge can accumulate on the outer insulating surface of a windshield. Electrical discharging can occur, usually in the form of surface flashing. The discharge generates electrical transients which might cause electromagnetic interference and damage to electrical components, depending on the system and component design. Methods of generating the electrostatic charge for test purposes and the control and evaluation of the discharges are covered. Potential damage to aircraft windshields from swept stroke lightning is evaluated by subjecting test specimens to man-made lightning. Recommendations are included which should enable the design of windshield systems that are more immune to the effects of precipitation static charging and swept stroke lightning. A study of the effects of nuclear electromagnetic pulse (EMP) in windshield design was added to the contract, with the results included in an appendix to this report. Author (GRA)

N77-26128# Defense Systems Management School, Fort Belvoir, Va.

PROJECT MANAGEMENT OF ARMY AIRCRAFT SURVIVABILITY EQUIPMENT

William A. Allen Nov. 1976 47 p refs

(AD-A036785) Avail: NTIS HC A03/MF A01 CSCL 01/3

Efforts by the U.S. Army to improve the survivability characteristics of its combat aircraft resulted in a proliferation of modifications ranging from simple airframe changes to the development of extremely complex electronic countermeasures. To effect centralized management of the development, procurement, and deployment of survivability enhancing equipment, it was necessary to establish the Aircraft Survivability Project Manager's Office within the U.S. Army Aviation Systems Command. This report addresses the policies, regulations, missions, responsibilities, and management concepts employed by the Project Manager and supporting organizations in the realization of this goal. Author (GRA)

N77-26129# Sikorsky Aircraft, Stratford, Conn.

DESIGN SELECTION TESTS FOR TRAC RETRACTION MECHANISM Final Report

Harold K. Frint Jan. 1977 101 p refs

(Contract DAAJ02-72-C-0049)

(AD-A037307; SER-50975; USAAMRDL-TR-76-43) Avail: NTIS HC A06/MF A01 CSCL 01/3

An investigation was conducted to select appropriate materials for and to demonstrate the satisfactory operation of a full scale jackscrew and nut assembly for a TRAC variable-diameter helicopter rotor blade. The investigation successfully demonstrated the operation of a suitable material combination in the jackscrew/nut configuration, with more than 300 full retraction-extension cycles under full design load and rotational speed conditions. The operation of the system improved significantly as the test progressed, with the coefficient of friction, the temperature rise, and the wear rate all decreasing with time. This result confirms that successful full-scale development of the TRAC rotor concept is achievable. It was concluded that a wear life on the order of 1,000 retraction-extension cycles can be achieved in a production design. A materials evaluation phase of the investigation utilized rings of selected material combinations to simulate a single thread contact. The preferred material/lubricant combination that emerged from these tests was a high-strength maraging-steel screw, coated with vitrolube dry-film lubricant, and a carbon-graphite nut. Author (GRA)

N77-26130# Army Aeromedical Research Lab., Fort Rucker, Ala.

AEROMEDICAL EVALUATION OF UH-1 INTERNAL

ADVANCED PERSONNEL RESCUE HOISTS, WESTERN GEAR CORPORATION HOIST MODELS 42277R1 AND 42305R1, BREEZE CORPORATION HOIST ECP-720 MODIFICATION

Frank S. Pettyjohn, Terry E. Gee, Lloyd A. Akers, George P. Rice, William F. Carroll, Pierre Allemond, Stephem M. Bailey, Raymond T. Burden, and Thomas G. Harrison Feb. 1977 57 p refs

(AD-A037621; USAARL-77-7) Avail: NTIS HC A08/MF A01 CSCL 06/7

The U.S. Army Aeromedical Research Laboratory was tasked to provide aeromedical evaluation of advanced high performance helicopter personnel rescue hoists. Physiologic effects of increased hoist speed were evaluated and proven to be minimal at speeds of 500 feet per minute. Available helicopter electrical power provides speed up to 250 feet per minute under load limitation. State-of-the-art 'off the shelf' rescue hoists were sought to provide immediate relief of the current 'life or death' restriction of the U.S. Army Helicopter Air Ambulance units. Safety, continuous cycle function, improved speed and increased operational capabilities were specifically evaluated. GRA

N77-26131# Systems Control, Inc., Palo Alto, Calif. Aeronautical and Marine Systems Div.

MODEL STRUCTURE DETERMINATION AND TEST INPUT SELECTION FOR IDENTIFICATION OF NONLINEAR REGIMES Engineering Technical Report, 1 Jan. - 31 Dec. 1975

Narendra K. Gupta and W. Earl Hall, Jr. Aug. 1976 86 p refs

(Contract N00014-72-C-0328)

(AD-A037831; SCAMS-TR-107; ONR-CR215-213-5) Avail: NTIS HC A05/MF A01 CSCL 12/1

This report describes techniques for model structure estimation and test input design for system identification in nonlinear vehicle regimes. Optimal methods for parameterizing estimation problems are discussed. For those regions where aerodynamic or hydrodynamic force and moment models are not known, the use of splines in approximating unknown nonlinear effects is discussed. Finally, methods for selecting inputs which enhance system identifiability are described. Author (GRA)

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N77-26132# Dynamics Research Corp., Wilmington, Mass.

DIGITAL AVIONICS INFORMATION SYSTEM (DAIS): CURRENT MAINTENANCE TASK ANALYSIS Final Report, May 1975 - Jun. 1976

Herbert E. Engel, John M. Glasier, Richard A. Dowd, Marjorie A. Bristol, and H. Anthony Baran Oct. 1976 97 p refs

(Contract F33615-75-C-5218)

(AD-A035683; AFHRL-TR-76-71) Avail: NTIS HC A05/MF A01 CSCL 01/3

The equipment used as the basis for performing this maintenance task analysis is a DAIS-configured conceptual design configuration described in Mid-1980s Digital Avionics Information System Conceptual Design Configuration, AFHRL-TR-76-59. It is an avionics design configuration suitable for a close air support (CAS) mission that is based on currently available military inventory but reconfigured in accordance with DAIS concept of sensors communicating with a central processor and integrated controls and displays through a multiplex bus. This report describes the methodology used in obtaining reliability and maintainability (R and M) data its display in a standardized schematic format called a Maintenance Task Network, the partitioning of the historical R and M factors in accord with the hardward partitioning, and the use of figures of merit, derived from the partitioned R and M data, to rank the subsystems in terms of their impact on mission effectiveness, manpower resources utilization, and operation and maintenance (O and M) costs. The maintenance task analysis will serve as a baseline for a second maintenance task analysis based on a mid-1980s DAIS design configuration. It will provide inputs for an R and M model which will, in conjunction with standard cost factors, permit the computation of O and M costs. It will provide the equipment-related portion of the data needed for the operation of the DAIS training model which will derive the best methods to train the required maintenance manpower. The numerical values derived from the maintenance task analysis appear as the current maintenance task analysis data bank. GRA

N77-26133# Battelle Columbus Labs., Ohio.

AVIONICS EVALUATION PROGRAM: MULTIPLE AIRCRAFT, MULTIPLE SORTIES AND COST ACCUMULATION Final Report, 15 Jan. - 30 Jun. 1976

Ronald A. Brown Wright-Patterson AFB, Ohio AFAL Jan. 1977 111 p refs

(Contract F33615-76-C-1069)

(AD-A037195; AFAL-TR-76-196) Avail: NTIS HC A06/MF A01 CSCL 01/3

An updated version of the air-to-ground Avionics Evaluation Program (AEP) has been developed. The AEP provides a mechanism for assessing the mission impact of varying avionics hardware configurations. This program is a Monte Carlo simulation of a flight of aircraft (up to four) through a specified number of days of operation. Functions considered include ground maintenance, communication, navigation, refueling, target acquisition, and weapon delivery. The present effort incorporated imperfect equipment monitoring, multiple aircraft, multiple sorties, and cost accumulation. The previous framework for consideration of hardware reliability and backup modes has been retained. The interactive graphics processor has been updated. A more convenient technique for accessing hardware and function data has been incorporated. More flexibility has been added to the output processor to allow selective display of simulation results. Author (GRA)

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N77-26134*# Curtiss-Wright Corp., Wood-Ridge, N.J.

PERFORMANCE, EMISSIONS, AND PHYSICAL CHARACTERISTICS OF A ROTATING COMBUSTION AIRCRAFT ENGINE

M. Berkowitz, W. L. Hermes, R. E. Mount, and D. Myers Dec. 1976 116 p refs

(Contract NAS3-20030)

(NASA-CR-135119; CW-WR-76-028.2) Avail: NTIS HC A06/MF A01 CSCL 21A

The RC2-75, a liquid cooled two chamber rotary combustion engine (Wankel type), designed for aircraft use, was tested and representative baseline (212 KW, 285 BHP) performance and emissions characteristics established. The testing included running fuel/air mixture control curves and varied ignition timing to permit selection of desirable and practical settings for running wide open throttle curves, propeller load curves, variable manifold pressure curves covering cruise conditions, and EPA cycle operating points. Performance and emissions data were recorded for all of the points run. In addition to the test data, information required to characterize the engine and evaluate its performance in aircraft use is provided over a range from one half to twice its present power. The exhaust emissions results are compared to the 1980 EPA requirements. Standard day take-off brake specific fuel consumption is 356 g/KW-HR (.585 lb/BHP-HR) for the configuration tested. Author

N77-26135*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

BORON/ALUMINUM FAN BLADES FOR SCAR ENGINES Final Report

R. G. Stabrylla and R. G. Carlson Jun. 1977 129 p ref
(Contract NAS3-18910)
(NASA-CR-135184) Avail: NTIS HC A07/MF A01 CSCL 21E

Processing procedures were developed to enhance boron/aluminum bond behavior and foreign object damage (FOD) tolerance. Design and analysis indicated that the J101 Stage 1 fan blade meets the required frequencies without a midspan shroud. The fabricability of full size J101 blades was assessed, while six blades were fabricated and finished machined. Author

N77-26136*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN OF TURBOFAN ENGINE CONTROLS USING OUTPUT FEEDBACK REGULATOR THEORY
Walter C. Merrill 1977 7 p refs Presented at the Joint Automatic Control Conf., San Francisco, 22-24 Jun. 1977
(NASA-TM-X-73622; E-9113) Avail: NTIS HC A02/MF A01 CSCL 21E

A multivariable control design procedure based on output feedback regulator (OFR) theory is applied to the F100 turbofan engine. Results for the OFR design are compared to a design based on linear quadratic regulator (LQR) theory. The OFR feedback control is designed in the full order state space and thus eliminates any need for model reduction techniques. Using the performance measure and control structure of the LQR design, an equivalent OFR feedback control is obtained. The flexibility of the OFR as a control design procedure is demonstrated, and differing feedback control structures are evaluated. Author

N77-26137*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE APPLICATION OF THE ROUTH APPROXIMATION METHOD TO TURBOFAN ENGINE MODELS
Walter C. Merrill 1977 11 p refs Presented at the Joint Autom. Control Conf., San Francisco, 22-24 Jun. 1977
(NASA-TM-X-73623; E-9114) Avail: NTIS HC A02/MF A01 CSCL 21E

The Routh approximation technique is applied in the frequency domain to a 16th order state variable turbofan engine model. The results obtained motivate the extension of the frequency domain formulation of the Routh method to the time domain to handle the state variable formulation directly. The time domain formulation is derived, and a characterization, which specifies all possible Routh similarity transformations, is given. The characterization is computed by the solution of two eigenvalue eigenvector problems. The application of the time domain Routh technique to the state variable engine model is described, and some results are given. Author

N77-26138# Committee on Public Works and Transportation (U. S. House).
AIRCRAFT NOISE
Washington GPO 1976 27 p refs Hearing before Subcomm. on Aviation of the Comm. on Public Works and Transportation, 94th Congr., 2d Sess., 9 Sep. 1976
(GPO-77-918) Avail: Subcomm. on Aviation

Efforts to meet FAR 36 noise emissions standards for subsonic transport aircraft and jet aircraft are discussed. Retrofitting of the existing fleet to bring it into compliance with FAR 36 was reviewed. Comparative effectiveness with time of three alternative aircraft modification programs in reducing impacted land area within NEF 30 + noise exposure contours at major U.S. airports is given. B.B.

N77-26139*# Boeing Vertol Co., Philadelphia, Pa.
STATIC, NOISE, AND TRANSITION TESTS OF A COMBINED-SURFACE-BLOWING V/STOL LIFT/PROPULSION SYSTEM
Allen H. Schoen, Charles E. Kolesar, and Edward G. Schaeffer Apr. 1977 254 p refs Sponsored in part by Navy
(Contract NAS2-9169)
(NASA-CR-151954; D210-11175-1) Avail: NTIS HC A12/MF A01 CSCL 21E

Efficient thrust vectoring and high levels of circulatory lift were obtained in tests of a half model V/STOL airplane by using a type of externally blown jet flap in which the jet exhaust from wing-mounted cruise fans is directed over both upper and lower surfaces of a flapped wing. Approximately 90% thrust recovery with 87 deg of thrust vectoring was achieved under static conditions using 89 deg of trailing edge flap deflection. The approximately 10% loss appears to be associated primarily with pressure losses due to the flap brackets or slot entries. The jet induced lift was shown to be 55% of the theoretical value for a fullspan jet-flapped wing, even though only 27.5% of the wingspan was immersed in the jet. Steady rate of descent capability in excess of 1,000 feet per minute is predicted. The possibility of significant aerodynamic-noise cancelling when blowing over both surfaces at high velocities is indicated. Author

N77-26140*# Boeing Commercial Airplane Co., Seattle, Wash.
STATIC AND WIND TUNNEL NEAR-FIELD/FAR-FIELD JET NOISE MEASUREMENTS FROM MODEL SCALE SINGLE-FLOW BASE LINE AND SUPPRESSOR NOZZLES. SUMMARY REPORT
Carl L. Jaeck Washington NASA Jun. 1977 102 p refs
(Contract NAS2-8213)
(NASA-CR-2841; D6-44121-3) Avail: NTIS HC A06/MF A01 CSCL 20A

A test program was conducted in the Boeing large anechoic test chamber and the NASA–Ames 40- by 80-foot wind tunnel to study the near- and far-field jet noise characteristics of six baseline and suppressor nozzles. Static and wind-on noise source locations were determined. A technique for extrapolating near field jet noise measurements into the far field was established. It was determined if flight effects measured in the near field are the same as those in the far field. The flight effects on the jet noise levels of the baseline and suppressor nozzles were determined. Test models included a 15.24-cm round convergent nozzle, an annular nozzle with and without ejector, a 20-lobe nozzle with and without ejector, and a 57-tube nozzle with lined ejector. The static free-field test in the anechoic chamber covered nozzle pressure ratios from 1.44 to 2.25 and jet velocities from 412 to 594 m/s at a total temperature of 844 K. The wind tunnel flight effects test repeated these nozzle test conditions with ambient velocities of 0 to 92 m/s. Author

N77-26141# AiResearch Mfg. Co., Phoenix, Ariz.
A FLUIDIC FUEL AND AIR BLEED LOAD CONTROL SYSTEM FOR GAS TURBINE ENGINES Final Report, 25 Aug. 1975 - 25 Aug. 1976
R. S. McCarty and H. R. Gamble 15 Dec. 1976 78 p
(Contract DAAG53-76-C-0012)
(AD-A035701; AiResearch-76-411516) Avail: NTIS HC A05/MF A01 CSCL 21/5

This is the final report of a program to develop a fluidic fuel and air bleed load control system for the AiResearch Model GTCP85-180 gas turbine engine. The basic functions provided by the control system include engine starting, speed governing, and bleed load extraction and exhaust gas temperature limiting. Author (GRA)

N77-26142# Acieries Reunies de Burbach-Eich-Dudelange S. A., Luxembourg.
THE GRAIN REFINEMENT OF ELECTROSLAG REMELTED Ni-BASE ALLOYS European Concerted Action. Cost 50 - Materials for Gas Turbines. Final Report
Francois Wagner 1 Sep. 1975 30 p refs Prepared jointly with Fulmer Res. Inst.
Avail: NTIS HC A03/MF A01

The results of an experimental investigation of the effects of stirring and nucleation agents during electroslag remelting (ESR) of a nickel-base alloy (Inconel 600) are described. Electromagnetic stirring at rates of 1 to 2 revolutions per second allowed melt rates to be increased by 20% without any increase in power requirement. Particles of identical composition to the melt can be added through the slag layer at critical addition rates and produce significant grain refinement (by up to a factor of 100). Stirring aids the symmetrical distribution of the particles and produces a good surface finish to the ingot. The initial results obtained on an ingot 75 mm in diameter are sufficiently promising to justify further investigation on larger ESR units for a wide range of high strength alloys. Author (ESA)

N77-26143# General Electric Co., Wilmington, Mass. Aerospace Instruments and Product Support Dept.
INTEGRATED ENGINE INSTRUMENT SYSTEM, VOLUME 1 Final Technical Report, 23 Jun. 1975 - 22 Jun. 1976
R. L. Skovholt, W. S. Little, W. A. Doerle, R. B. Cooper, C. E. Buzzell, H. L. McManus, Jr., and I. E. Marvin Jun. 1976 128 p 2 Vol.
(Contract N62269-75-C-0359)
(AD-A035565; NADC-76180-30-Vol-1) Avail: NTIS HC A07/MF A01 CSCL 21/5

Volume I contains the System Description of the Integrated Engine Instrument System (IEIS). In an effort to anticipate the needs of the flight crew and maintenance personnel in the 1980-85 timeframe, studies were conducted during the past five years to examine engine parameter definition and selection, sensor analysis, engine cycles, engine modeling, mission analysis, data trending, electronic fuel control, analog subsystems for vibration and turbine blade monitoring, display engineering, fault isolation techniques and human factors. The resulting baseline IEIS incorporates a variety of disciplines, including engine operation analysis, computers, multipurpose displays, data bus techniques, and data recording. Deck Launched Intercept and Subsonic Surface Surveillance missions were selected as typical applications for IEIS. GRA

N77-26144# General Electric Co., Wilmington, Mass. Aerospace Instruments and Product Support Dept.
INTEGRATED ENGINE INSTRUMENT SYSTEM, VOLUME 2 Final Technical Report, 23 Jun. 1975 - 22 Jun. 1976
R. L. Skovholt, W. S. Little, W. A. Doerle, R. B. Cooper, C. E. Buzzell, H. L. McManus, Jr., and I. E. Marvin Jun. 1976 171 p 2 Vol.
(AD-A035566; NADC-76180-30-Vol-2) Avail: NTIS HC A08/MF A01 CSCL 21/5

Contents: Appendix A - Transient Condition Monitoring for Advanced Military Engines; Appendix B - Integrated Engine Instrumentation System Improvement Study Based on Steady State Condition Monitoring Experience; Appendix C - Display Engineering; and Appendix D - IEIS Sensor Survey. GRA

N77-26145# ARO, Inc., Arnold Air Force Station, Tenn.
DETERMINATION OF THE EXCITED STATE DENSITY DISTRIBUTION WITHIN A NONEQUILIBRIUM, FREELY EXPANDING ARGON ARCJET PLUME Final Report, 1 Jul. 1974 - 1 Jan. 1976
C. C. Limbaugh AEDC Mar. 1977 127 p refs Sponsored by the Air Force
(AD-A037352; ARO-ETF-TR-76-101; AEDC-TR-77-23) Avail: NTIS HC A07/MF A01 CSCL 21/3

The distribution of the population densities of the excited states of argon was determined at two axial positions in the non-equilibrium, freely expanding plume of an argon d-c arcjet. Narrow-line absorption and concomitant radial inversion were used to obtain densities of the first four excited states of argon, which include the two metastable and two resonance states. Abel inversion of the absolute radiance measurements of emission from several spectral lines provided the number density of highly excited states, the excitation or electron temperature, and the electron number density. The distribution functions observed were decidedly nonequilibrium, with the first four excited states ranging from a factor of two to a factor of ten larger than that required for Saha equilibrium with free electron density. GRA

N77-26146# Air Force Civil Engineering Center, Tyndall AFB, Fla.
PREDICTION OF TEST CELL VISIBLE EMISSIONS Final Report, Jun. - Nov. 1976
Samuel P. Finch, III and Arland W. Eyl, Jr. Dec. 1976 42 p refs
(AD-A037694; AFCEC-TR-76-47) Avail: NTIS HC A03/MF A01 CSCL 21/5

A theoretical correlation between jet engine test cell plume opacity and Society of Automotive Engineers (SAE) engine smoke number (SN) was developed. Intermediate results provide soot loading at the exhaust plane of the engine, engine exhaust flow rates and test cell total air flow rate. The specific particle extinction coefficient which correlates light scattering properties with soot loading is the most difficult parameter to define. A value predicted from Mie theory is used for correlations close to the exhaust plane of the engine. At the exit plane of the exhaust stack agglomeration and scouring change the particle size distribution and individual particle density so that theoretical prediction is difficult. The value for specific particle extinction coefficient at the exhaust stack was chosen based on what little empirical data was available. When additional data becomes available, it should be possible to define this parameter more precisely.
Author (GRA)

N77-26147# Naval Postgraduate School, Monterey, Calif.
PULSATING COMBUSTION DEVICE MINIATURIZATION M.S. Thesis
Robert Kenneth Crowe Dec. 1976 68 p refs
(AD-A035707) Avail: NTIS HC A04/MF A01 CSCL 21/2

The phenomenon of pulsating combustion remains one of the least understood forms of combustion. In this thesis, combustion oscillations are classified into the categories of chamber oscillations, system oscillations, and intrinsic oscillations. Two pulsating devices, the pulsejet and the Reynst combustion pot, were studied in some detail. Experimentation was conducted to determine the miniaturization capabilities of the devices. Conclusions were drawn concerning the practicality of size reduction, and applications of the devices were suggested. Areas of possible future research are delineated that would further the development of the devices and their miniaturization.
Author (GRA)

N77-26148# Kaman Aerospace Corp., Bloomfield, Conn.
HELICOPTER NOISE REDUCTION DESIGN TRADE-OFF STUDY Final Report, Mar. 1976 - Jan. 1977
Michael A. Bowes Jan. 1977 238 p refs
(Contract DOT-FA76WA-3791)
(AD-A038192/1; R-1493; FAA-AEQ-77-4) Avail: NTIS HC A11/MF A01 CSCL 01/3

The noise reduction benefits and economic costs associated with applying state-of-art noise reduction methods to future design civil helicopters were studied. A survey of the make-up of the civil fleet was performed, and this fleet make-up was projected to the 1980 time frame. Analytical methods were developed and/or adopted for calculating helicopter component noise, and these methods were incorporated into a unified total vehicle noise calculation model. Analytical methods were also developed for calculating the effects of noise reduction methodology on helicopter design, performance, and cost. The analytical methods were used to calculate baseline noise and cost characteristics of several existing civil helicopters. These methods were also used to calculate changes in noise, design, performance and cost due to the incorporation of engine and main rotor noise reduction methods. All noise reduction techniques were evaluated in the context of an established mission performance criterion which included consideration of hover ceiling, forward flight range/speed/payload and rotor stall margin. Author

N77-26149# Westinghouse Electric Corp., Cheswick, Pa. Electro-Mechanical Div.
DESIGN AND DEVELOPMENT OF A SEGMENTED MAGNET HOMOPOLAR TORQUE CONVERTER Final Technical Report, 10 May 1972 - 30 Jun. 1976
C. J. Mole, F. G. Arcella, E. Berkey, D. J. Boes, and V. B. Ooshi Sep. 1976 321 p refs
(Contract DAHC15-72-C-0229; ARPA Order 2174)
(AD-A037259; EM-4883) Avail: NTIS HC A14/MF A01 CSCL 21/3

This program was for the research and development of a new mechanical power transmission concept: the segmented magnet homopolar torque converter. The purpose of this device is to convert unidirectional torque of constant speed (such as from a steam turbine prime mover) into variable speed output torque in either the forward or reverse directions. The concept offers an efficient, lightweight low volume design with potential application over a wide range of speeds and power ratings in the range from hundreds to tens of thousands of horsepower. This machine concept can be applied to commercial and military advanced concept vehicles for both terrain and marine environments. In Phase I the technical problems were reviewed, the

machine concepts were studied, and a detailed technical plan was evolved for the entire program. In Phase II, a reliable constant speed current collection system was developed and demonstrated in an actual segmented magnet homopolar generator (SEGMAG). The objective of Phase III was to extend the technology developed in Phase II for constant speed machines to the case of the torque converter which must operate at variable and reversing speeds. The program places particular emphasis on the technology of advanced current collection systems for the reason this is essential for the success of the homopolar machine concept. Phases I, II, and the initial Phase III effort were based on the use of liquid metal current collectors. GRA

N77-26150# United Technologies Research Center, East Hartford, Conn.
DEVELOPMENT OF DIRECTIONALLY SOLIDIFIED EUTECTIC NICKEL ALLOYS FOR USE IN AIRCRAFT GAS TURBINES AT METAL TEMPERATURES EXCEEDING 1000 C Final Report, 8 Apr. - 7 Oct. 1976
F. D. Lemkey 7 Nov. 1976 68 p refs
(Contract N62269-76-C-0107; WF54592201)
(AD-A037246; UTRC/R76-912518-3; NADC-75208-30) Avail: NTIS HC A04/MF A01 CSCL 11/6

Investigations to develop an isotropically ductile high temperature eutectic by ternary modifications and quaternary or quinary additions to the monovariant eutectic gamma/gamma-alpha (Ni3Al/Ni-Mo) were performed. Extensive substitutions (=7 w/o) of chromium, cobalt, iron and tantalum and more limited substitution of tungsten, rhenium, titanium, and carbon demonstrated the wide flexibility of alloying. Tantalum and rhenium additions improved the high temperature creep strength and tantalum additions combined with chromium (i.e. Ni-32 w/o Mo-5.5 w/o Al-3 w/o Cr-1 w/o Ta) yielded an alloy whose cyclic oxidation resistance at 1000 C compared favorably to the outstanding oxidataion resistant nickel-base superalloy, B-1900. Since the measured coefficient of thermal expansion of gamma/gamma-alpha alloys are below the CTE's of conventional coatings the requirement of a compatible lower expansion coating was indicated. The ultimate shear strengths of gamma/gamma-alpha alloys at intermediate temperatures (760-880 C) were found to be equivalent to nickel base superalloys. However, the shear creep rupture properties at 760 C were below those of the more isotropic superalloys. The thermal fatigue resistance of gamma/gamma-alpha alloys was found to be dependent on aluminum content. Alloys containing 7.8 w/o Al exhibited substantially greater resistance to cyclic thermal fatigue (400-1122 C) under stress than both D.S. Mar M200 + Hf and gamma/gamma-delta. Author (GRA)

N77-26151# Battelle Pacific Northwest Labs., Richland, Wash.
APPLICATION OF SPUTTER-DEPOSITED LAMELLAR COMPOSITE TECHNOLOGY TO THE DEVELOPMENT OF HIGH TEMPERATURE TURBINE BLADE MATERIALS AND AIRFOIL FABRICATION Final Report, 1 May 1973 - 30 Jun. 1976
R. Busch, J. W. Patten, and H. R. Gardner Oct. 1976 38 p refs
(Contract F44620-73-C-0071; ARPA Order 2482)
(AD-A037349; AFOSR-77-0186TR) Avail: NTIS HC A03/MF A01 CSCL 11/2

Data and results from the third year's work on Application of Sputter-Deposited Lamellar Composite Technology to the Development of High Temperature Turbine Blade Materials and Airfoil Fabrication are presented and discussed. Author (GRA)

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N77-26152*# Kanner (Leo) Associates, Redwood City, Calif.
INFLUENCE OF POWER ON THE SPIN OF LIGHT PLANES
L. Beaurain Washington NASA Jun. 1977 65 p Transl. into ENGLISH of the report "Influence de la motorisation sur la vrille d'avions legers", Lille, France, Inst. de Fluides Mech. de Lille, report no. 77/15, etude no. 1289/ZY, May 5, 1977 p 1-35
(Contract NASw-2790)
(NASA-TT-F-17447) Avail: NTIS HC A04/MF A01 CSCL 01C

Various mock-ups are tested in wind tunnel experiments to study the effect of power on light plane spin with regard to the following propeller parameters: thrust, slipstream, gyroscopic torque and reversal torque. For right spin, the effect of the motor is either zero or anti-spin, never adverse. There appears to be no correlation between the geometry of certain components of the aircraft and the overall propeller effect. Author

N77-26153*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPLORATORY INVESTIGATION OF THE INCIPIENT SPINNING CHARACTERISTICS OF A TYPICAL LIGHT GENERAL AVIATION AIRPLANE
Richard J. Ranaudo [1977] 43 p refs
(NASA-TM-X-73671; E-9190) Avail: NTIS HC A03/MF A01 CSCL 01C

The incipient spinning characteristics of general aviation airplanes were studied. Angular rates in pitch, yaw, and roll were measured through the stall during the incipient spin and throughout the recovery along with control positions, angle of attack, and angle of sideslip. The characteristic incipient spinning motion was determined from a given set of entry conditions. The sequence of recovery controls were varied at two distinct points during the incipient spin, and the effect on recovery characteristics was examined. Aerodynamic phenomena associated with flow over the aft portion of the fuselage, vertical stabilizer, and rubber are described. Author

N77-26154*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DESCRIPTION AND FLIGHT TESTS OF AN OCULOMETER
David B. Middleton, George J. Hurt, Jr., Marion A. Wise, and James D. Holt Washington Jun. 1977 33 p refs
(NASA-TN-D-8419; L-11115) Avail: NTIS HC A03/MF A01 CSCL 01D

A remote sensing oculometer was successfully operated during flight tests with a NASA experimental Twin Otter aircraft at the Langley Research Center. Although the oculometer was designed primarily for the laboratory, it was able to track the pilot's eye-point-of-regard (lookpoint) consistently and unobtrusively in the flight environment. The instantaneous position of the lookpoint was determined to within approximately 1 deg. Data were recorded on both analog and video tape. The video data consisted of continuous scenes of the aircraft's instrument display and a superimposed white dot (simulating the lookpoint) dwelling on an instrument or moving from instrument to instrument as the pilot monitored the display information during landing approaches. Author

N77-26155# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge-Entwicklung.
PRESENT-DAY ROLE OF CONTROL AND STABILITY AUGMENTATION SYSTEMS AND FUTURE TRENDS
Gerhard Kissel 6 Oct. 1975 113 p refs Presented at Lecture Series 80 Aircraft Stability and Control, Brussels 12-16 May, 1975
(MBB-UFE-1182(O)) Avail: NTIS HC A06/MF A01

The possibilities for performance improvement of aircraft by using flight control systems are surveyed based on present developments in fly-by-wire control. These improvements are possible only if the external configuration of the aircraft can be modified directly at the design stage of the overall flight control system. It is shown that the equipment redundancy can be reduced without endangering safety limits by efficient utilization and configuration of all control surfaces. An application for a fighter aircraft design is described. ESA

N77-26156# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge-Entwicklung.
TREATMENT OF THE NONLINEAR VIBRATION OF A

VARIABLE SWEEP AIRCRAFT WING WITH ITS DRIVE USING A SIMPLIFIED WING MODEL [BEHANDLUNG DES NICHTLINEAREN SCHWINGUNGSVERHALTENS EINES SCHWENKBAREN FLUGZEUGFLUEGELS MIT SEINEM VERSTELLANTRIEB MITTELS EINES VEREINFACHTEN SCHWINGUNGSMODELLS]

Beate Schoen 1 Aug. 1975 155 p refs In GEORGIAN (MBB-UFE-1191(O)) Copyright. Avail: NTIS HC A08/MF A01

A wing vibration model was constructed to investigate the vibration behavior of a variable sweep wing with its pivot drive. The model provides for simulation of the clearance, the static friction, and damping proportional to velocity. The physical vibration behavior was investigated by variation of these parameters. The complex phenomenon was also studied theoretically by approximation solutions, and the dependence on parameter variations indicated. Experimental and theoretical results are combined to provide a complete picture of the vibration phenomenon. ESA

N77-26157# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abt. Regelungssysteme.

EFFECT OF GUST MODELLING ON THE IDENTIFICATION OF THE LONGITUDINAL MOTION DERIVATIVES OF AN AIRCRAFT

Gerd Schulz 22 Nov. 1976 39 p refs In GERMAN; ENGLISH summary

(DLR-FB-76-63) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 17

The effect of stochastic modeling of horizontal and vertical gusts on the Maximum Likelihood Identification of derivatives of the longitudinal motion of the HFB-320 aircraft was investigated. Three different modelings of the power spectral densities of the gusts were considered. It is shown that the outputs are more affected than the estimates of the derivatives. The best curve fit occurs for modeling of the power spectral densities of the gust by a first order Gauss-Markov process. Author (ESA)

N77-26158# Naval Air Development Center, Warminster, Pa. Dept. of Air Vehicle Technology.

LOW-SPEED V/STOL STABILITY AND CONTROL PREDICTION. VOLUME 1: MODEL DESCRIPTION AND VALIDATION Interim Report

J. W. Clark, Jr. 11 Jan. 1977 81 p refs

(AD-A037688; NADC-76312-30-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 20/4

A unified prediction method is developed to support V/STOL Stability and Control analyses. The method is geared to a preliminary design environment to facilitate its application using the limited type of data normally available early in the design process. This volume describes the models which were developed or modified and their validation. GRA

N77-26159# Naval Air Development Center, Warminster, Pa. Dept. of Air Vehicle Technology.

LOW-SPEED V/STOL STABILITY AND CONTROL PREDICTION. VOLUME 2: COMPUTER PROGRAM USER MANUAL Interim Report

J. W. Clark, Jr. 11 Jan. 1977 147 p

(AD-A037689; NADC-76313-30-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 20/4

The computer program incorporating these models and the associated input data requirements and output format are described. For Vol. 1, see N77-26158. Author (GRA)

N77-26160# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Aeroballistics Directorate.

THE EFFECTIVENESS OF CANARDS FOR ROLL CONTROL

James R. Burt, Jr. Nov. 1976 68 p refs

(DA Proj. 1W3-62303-A-214)

(AD-A037077; RD-77-8) Avail: NTIS HC A04/MF A01 CSCL 01/3

A study of the roll control effectiveness of small, nose mounted canards is presented. Mach number was varied from 0.6 to 4.5, canard differential deflection from -3 deg to 5 deg, and angle of attack from -3 deg to 6 deg. The canards were small with a clipped delta planform and were tested in two longitudinal nose positions in combination with both a planar tail and a ring tail. It is shown that the effectiveness of small, nose mounted canards as roll control devices depends upon tail shape. Author (GRA)

N77-26161# Advisory Group for Aerospace Research and Development, Paris (France).

TASK-ORIENTED FLIGHT CONTROL SYSTEMS

May 1977 116 p refs Lecture ser. held at London, 9-10 Jun. 1977, and Wright-Patterson AFB, Ohio, 14-15 Jun. 1977

(AGARD-LS-89; ISBN-92-835-1242-1) Avail: NTIS HC A06/MF A01

Control law design techniques, the need for and implementation of task oriented control laws, and additional degrees of freedom and associated task oriented flight control system functions were discussed. A bibiography is presented. For individual titles, see N77-26162 through N77-26167.

N77-26162# Royal Aircraft Establishment, Farnborough (England).

TASK-ORIENTED FLIGHT CONTROL SYSTEMS: INTRODUCTION AND OVERVIEW

Geoffrey H. Hunt *In* AGARD Task-Oriented Flight Control Systems May 1977 3 p ref (For primary document see N77-26161 17-08)

Avail: NTIS HC A06/MF A01

The development of high-integrity programmable control systems is discussed. A range of possibilities for their introduction into future aircraft, including that of task-oriented controls, is presented. An overview of some of the implications and problems, as well as the advantages, of applying these control systems to piloted aircraft is given. Author

N77-26163# Royal Aircraft Establishment, Farnborough (England). Flight Systems Dept.

ENGINEERING OF CONTROL SYSTEMS AND IMPLICATIONS ON CONTROL LAW DESIGN

F. R. Gill *In* AGARD Task-Oriented Flight Control Systems May 1977 18 p refs (For primary document see N77-26161 17-08)

Avail: NTIS HC A06/MF A01

The state-of-the-art of multiplexed digital flight control systems (FCS) against a background of the integrity requirements and the means of achieving integrity was reviewed. As an introduction, the need for variable and changeable control is discussed, and the potential of pilot selectable task oriented control is examined. Limitations to the performance of aircraft plus its FCS result from limitations in FCS components and subsystems, and the control policies that can be applied with confidence. Author

N77-26164# General Electric Co., Fairfield, Conn.

THE NEED FOR TASK ORIENTED CONTROL LAWS

R. P. Quinlivan *In* AGARD Task-Oriented Flight Control Systems May 1977 9 p refs (For primary document see N77-26161 17-08)

Avail: NTIS HC A06/MF A01

Several example weapon delivery problems were examined and their requirements pointed out. The need for task oriented control laws was discussed as becoming important when aircraft controllability is important to mission completion. Task oriented control laws addressed the question of input-output relation which requires consideration of the location of the system zeros as well as the poles. The aircraft, the kinematics, weapon aiming dynamics, required guidance laws, and the pilot are all discussed as part of the task oriented control law. Author

N77-26165# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.

IMPLEMENTATION OF TASK-ORIENTED CONTROL LAWS

R. Onken *In* AGARD Task-Oriented Flight Control Systems May 1977 17 p refs (For primary document see N77-26161 17-08)

Avail: NTIS HC A06/MF A01

The implementation of control laws was considered as a certain phase of the control system development, where the system environment around the control law was taken into account

with respect to the specific system mission. A number of implications on the control law are typical for this development phase. Those, caused by design aspects, choice of components and the external atmospheric environment, are discussed. Author

N77-26166# McDonnell Aircraft Co., St. Louis, Mo. Guidance and Control Mechanics.
ADDITIONAL DEGREES OF FREEDOM
M. J. Wendl *In* AGARD Task-Oriented Flight Control Systems May 1977 19 p refs (For primary document see N77-26161 17-08)
Avail: NTIS HC A06/MF A01

Additional degrees of freedom consisting of direct lift and direct side force are introduced, and associated task oriented flight control system functions are discussed. Direct lift systems which improve the capability of both commercial and conventional fighter aircraft are presented. The impact of a fly-by-wire implementation on the aerodynamic and structural design of a Vectored Lift Fighter concept is discussed. It is shown that these additional degrees of freedom lead to innovative modes of operation. Maneuver enhancement with direct lift and wings level turning with direct side force are presented. Technical considerations related to vertical and lateral translation and fuselage aiming mode implementations are reviewed. Pilot interface techniques and blended control are introduced. Guidelines for using the additional degrees of freedom are presented. Author

N77-26167# Defence Research Information Centre, Orpington (England).
BIBLIOGRAPHY ON TASK-ORIENTED FLIGHT CONTROL SYSTEMS
H. J. Birkby, comp. and G. H. Hunt, comp. (RAE, Farnborough, England) *In* AGARD Task-Oriented Flight Control Systems May 1977 39 p refs (For primary document see N77-26161 17-08)
Avail: NTIS HC A06/MF A01

This bibliography lists the benefits, problems, design and engineering aspects of recent developments in the flight control systems of manned aircraft. A broad review of the state-of-the-art in modern flight control theory and practice is given. The concepts of task-oriented control systems, and some recent relevant simulator and flight trials are also discussed. Author

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N77-26168# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soils and Pavements Lab.
COMPARATIVE PERFORMANCE OF STRUCTURAL LAYERS IN PAVEMENT SYSTEMS. VOLUME 4: ANALYSIS OF INSULATING LAYERS IN PAVEMENT TEST SECTIONS Final Report
Walter R. Barker and Frazier Parker, Jr. Jan. 1977 145 p refs
(Contract DOT-FA71WAI-218)
(AD-A038116/0; S-74-8-Vol-4; FAA-RD-73-198-Vol-4) Avail: NTIS HC A07/MF A01 CSCL 01/5

Pavements containing insulating layers were tested to determine the structural adequacy of pavements containing the various types of insulating materials and to determine the location of the insulating layers to ensure adequate structural performance of the pavements. Conclusions from the study indicate that the insulating materials behave differently than conventional paving materials. For flexible pavement design, the vertical compressive stresses and horizontal tensile stresses in the insulating materials should be kept below measured strength values. For rigid pavement design, granular or chemically stabilized base or subbase material should be provided between the concrete slab and the insulating material, and a base or subbase course should be placed between the polystyrene panels and subgrade materials susceptible to pumping. Author

N77-26169# Naval Training Equipment Center, Orlando, Fla.
DELAY OF VISUAL FEEDBACK IN AIRCRAFT SIMULATORS Final Technical Note, Nov. 1976 - Mar. 1977
Gilbert L. Ricard and Joseph A. Puig Mar. 1977 46 p refs (AD-A037839; NAVTRAEQUIPC-TN-56) Avail: NTIS HC A03/MF A01 CSCL 05/5

The literature of the manual control of systems incorporating delays in the presentation of visual information is reviewed for the development of specifications for flight simulator visual displays. Several cases are presented where display delays have affected the use of operational simulation devices, and the means currently used to contend with those delays are discussed. Two approaches to preparing specifications are offered and available information relevant to each is presented. Author (GRA)

N77-26170# European Space Agency, Paris (France).
A COMPUTER PROGRAM FOR THE DESIGN OF PLANE AND AXISYMMETRIC SUPERSONIC WIND TUNNEL NOZZLES
Kurt Gruemmer May 1977 89 p refs Transl. into ENGLISH of 'Ein Rechenprogramm fuer den Entwurf ebener u. rotationssymmetrischer Ueberschallwindkanalduesen', DFVLR, Cologne Report DLR-FB-76-59, 9 Nov. 1976 Original report in GERMAN previously announced as N77-20121 Original German report available from DFVLR, Cologne DM 34.30
(ESA-TT-367; DLR-FB-76-59) Avail: NTIS HC A05/MF A01

A FORTRAN 4 program to calculate the nozzle contour of supersonic wind tunnel nozzles with different slenderness ratio, including the shortest possible overall length, is presented. Since the Prandtl-Meyer corner flow is used the supersonic flow field of the nozzle generally shows gasdynamic waves of first order accompanied by discontinuities in the curvature of the stream lines. Author (ESA)

N77-26171# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
AERONAUTICAL SYSTEMS TECHNOLOGY NEEDS. TEST FACILITIES AND TEST EQUIPMENT Annual Report, Jan. - Dec. 1977
Donald C. Kittinger Jan. 1977 28 p Supersedes ASD-TR-76-13
(AD-A035252; ASD-TR-77-3) Avail: NTIS HC A03/MF A01 CSCL 15/5

This report is a part of a compilation of formalized Technology Needs TN covering Equipment Subsystems as identified by the Aeronautical Systems Division. They are based on development/operational experience, system studies and new concepts - all related to future system applications. Their presentation is to serve a threefold purpose i.e., (1) guidance for techology program, (2) proven development potential, and (3) engineering data/requirements essential for technology use in systems. The identified needs delineate progress desired in performance, control, design flexibility, safety, and cost. Author (GRA)

N77-26172# Information Spectrum, Inc., Arlington, Va.
AVIATION SIMULATION MASTER PLAN, PHASE 1. VOLUME 1 Final Report
Neil V. Campbell, Richard H. Davis, Robert E. Duvall, Ronald P. Richter, and Troy E. Todd Feb. 1977 395 p refs 2 Vol.
(Contract N68335-76-C-3387)
(AD-A037803; Rept-1268-1; NAVAIR-Air-413-6MPXYO-1) Avail: NTIS HC A17/MF A01 CSCL 01/2

This report describes the Phase 1 results of the two-stage development of a master plan for the management, operation, and support of the Navy's aviation simulation program for flight training. Phase 1 describes and analyzes the existing system, and identifies missing elements and areas wherein improvements may be possible. Phase 2 will involve development of criteria for an optimum simulation plan, the preparation of plans of action and milestones to resolve the problems identified in Phase 1 and an update of the Phase 1 data. The master plan will be a consolidation of the Phase 1 and Phase 2 efforts. The objectives of the Phase 1 report are to provide a source document for management information and to present an overview of the planning, programming, and budgeting system for major aviation

operator training devices. The report covers the Navy's R and D program for simulation and the process for establishing operational requirements for major aviation training devices. The planning/programming/budgeting process for simulators and the procurement and production actions required are described in detail. The report documents the system used in the management of operation and support of flight simulators. In addition, extensive background information and detailed program data are provided in the appendices. Author (GRA)

N77-26173# Naval Air Test Center, Patuxent River, Md.
MAXIMIZING FLIGHT FIDELITY INTEGRATION OF NAVAL AIR TEST CENTER CAPABILITIES INTO THE PROCUREMENT OF MAJOR AVIATION TRAINING DEVICES
R. T. Galloway 16 Mar. 1977 15 p refs Presented at the 9th Naval Training Equipment Center Industry Conf., Orlando, Fla., 9-11 Nov. 1976
(AD-A037687; NATC-TM-76-4-SA) Avail: NTIS HC A02/MF A01 CSCL 14/2

Flight test engineers and test pilots from NATC have recently become involved with flight fidelity testing of Operational Flight Trainers and Weapons System Trainers. The purpose of this flight fidelity testing is to determine if the simulator flying qualities, performance, and systems operation are quantitatively representative of the design basis aircraft. Initial NATC involvement in Operational Flight Trainers and Weapons System Trainers acceptance testing commenced in the final acceptance test period which resulted in considerable delays since extensive software changes were sometimes required to correct flight fidelity deficiencies. Therefore, a new Navy test policy for Operational Flight Trainers and Weapons System Trainers acceptance was developed by representatives of NATC, Naval Training Equipment Center, and NAVAIR. This paper outlines the major elements of the new policy whereby NATC participation is included much earlier in the Operational Flight Trainers and Weapons System Trainers procurement cycle to monitor development and provide flight test assistance as soon as practicable. In addition, NATC flight fidelity test methods are discussed in general.
Author (GRA)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N77-26174*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.
UPDATED DISPERSION ANALYSIS FOR THE FIRST ORBITAL FLIGHT TEST (OFT-1) MISSION
L. S. Snow 20 May 1977 36 p refs
(Contract NAS9-14969)
(NASA-CR-151434; DN-1.4-7-54) Avail: NTIS HC A03/MF A01 CSCL 22A

A dispersion analysis considering 3-sigma uncertainties (or perturbations) in platform, vehicle, and environmental parameters was performed for the first orbital flight test (OFT-1) mission. The dispersion analysis is based on the nominal trajectory for the OFT-1 reference flight profile and was performed to determine state vector and performance dispersions (or variations) which result from the indicated 3 sigma uncertainties. The dispersions are determined at major mission events and fixed times from liftoff (time slices). Principal error contributors to the covariance matrix are listed. The dispersion data indicates that the largest position error occurs in the down range component. At main engine cutoff and circularization, the vehicle performance uncertainties are the major contributors to down range error.
Author

N77-26175*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.
EULER ANGLES, QUATERNIONS, AND TRANSFORMATION MATRICES FOR SPACE SHUTTLE ANALYSIS
D. M. Henderson 9 Jun. 1977 40 p refs
(Contract NAS9-14960)
(NASA-CR-151435; DN-1.4-8-020) Avail: NTIS HC A03/MF A01 CSCL 22A

Relationships between the Euler angles and the transformation matrix, the quaternion and the transformation matrix, and the Euler angles and the quaternion are analyzed, and equations developed are applied directly to current space shuttle problems. The twelve three-axis Euler transformation matrices as functions of the Euler angles, the equations for the quaternion as a function of the Euler angles, and the Euler angles as a function of the transformation matrix elements are included along with a group of utility subroutines to accomplish the Euler matrix, quaternion matrix, and Euler quaternion relationships. Author

N77-26176*# IIT Research Inst., Chicago, Ill.
SPACE PROCESSING OF CHALCOGENIDE GLASS Final Report, 22 Feb. 1974 - 30 Sep. 1976
D. C. Larsen and M. I. Ali 30 Mar. 1977 97 p refs
(Contract NAS8-30627; IITRI Proj. D6096)
(NASA-CR-150311) Avail: NTIS HC A05/MF A01 CSCL 22A

The manner in which the weightless, containerless nature of in-space processing can be successfully utilized to improve the quality of infrared transmitting chalcogenide glasses is determined. The technique of space processing chalcogenide glass was developed, and the process and equipment necessary to do so was defined. Earthbound processing experiments with As2S3 and G28Sb12Se60 glasses were experimented with. Incorporated into these experiments is the use of an acoustic levitation device. Author

N77-26177*# Computer Sciences Corp., Silver Spring, Md.
SKYLAB S191, S192 PROGRAM DESCRIPTIONS
M. Mack Feb. 1976 424 p refs
(Contract NAS5-11999)
(NASA-CR-152508) Avail: NTIS HC A18/MF A01 CSCL 22A

Software developed to assist in assessing and analyzing earth radiation data obtained from Skylab S191 and S192 experiments are described. A block data generation routine is included along with a plot program for the S191 experiment. Changes in format from that of the original JSC tapes are discussed. A.R.H.

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N77-26178# Sandia Labs., Albuquerque, N. Mex. Aerothermodynamics Div.
CALCULATING THE ABLATION OF LARGE SPHERES ENTERING THE ATMOSPHERE AT METEORIC VELOCITIES
George F. Wright and Donald D. McBride Dec. 1976 47 p refs
(Contract E(29-1)-789)
(SAND-76-0311) Avail: NTIS HC A03/MF A01

The ablation of large spherical bodies entering the earth's atmosphere at meteoric velocities is calculated for a range of initial diameters, velocities, and reentry angles. An expression for the total mass loss is derived which includes the effects of thermal radiation, convective, heat transfer, and the mass blowing effect on the boundary layer. The solution is coupled with the trajectory to account for changes in ballistic coefficient during ablation. Plots of the radiative heat transfer rate are also presented. ERA

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

N77-26179# Federal Electric Corp., Vandenberg AFB, Calif.
RADAR RANGE CALIBRATOR SYSTEM EVALUATION REPORT Final Report, 1 Sep. - 2 Dec. 1976
James P. Bryan 2 Dec. 1976 23 p
(Contract F04701-72-C-0203)
(AD-A037134; SAMTEC-TR-77-32) Avail: NTIS HC A02/MF A01 CSCL 17/9

The Range Calibrator System was installed at the Pillar Point AN/FPQ-6 radar during September 1976. The system is capable of generating a target at a known range using digital techniques. An evaluation of this system is presented in this report.
Author (GRA)

N77-26180# Army Electronics Command, Fort Monmouth, N. J.
MODIFIED AN/PSM-13 FOR FIELD TESTING BA-4386/PRC-25
Donald B. Wood Jan. 1977 32 p
(AD-A037002; ECOM-4461) Avail: NTIS HC A03/MF A01 CSCL 14/2

Test set, Battery, AN/PSM-13, using the loaded voltmeter technique, was designed to predict minimum remaining capacity for a number of zinc-carbon batteries. When the magnesium Battery BA-4386/PRC-25 was introduced into the military supply system, Test Set Battery AN/PSM-13 was used with this battery but with inaccurate results. A program was established to determine the factors that influence the operation of the AN/PSM-13 with the magnesium Battery BA-4386/PRC-25 and to design and fabricate a modified version of the tester which would adequately test the battery. Two loaded voltage values were selected to predict the battery state-of-charge relative to its use in Radio Set AN/PRC-77. The upper voltage point indicates that at least 85% of the battery's fresh capacity is remaining; the lower point no less than 15%. A reading between the two points indicates the battery has at least 15% of its capacity remaining; however, it could have up to 100%. The results of the evaluation to determine the accuracy of the modified AN/PSM-13 in predicting the capacity remaining in Battery BA-4386/PRC-25 are presented. Author (GRA)

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N77-26181*# Sperry Flight Systems, Phoenix, Ariz.
AN EVALUATION OF REACTION WHEEL EMITTED VIBRATIONS FOR SPACE TELESCOPE Final Report
Mar. 1977 108 p ref
(Contract NAS8-31998)
(NASA-CR-150303; Publ-71-0989-00-00) Avail: NTIS HC A06/MF A01 CSCL 22B

Emitted forces and moments characteristics of the Space Telescope Reaction Wheel Assembly (ST RWA) were measured under room temperature and pressure, thermal extremes, and vibratory conditions. The RWA/Emitted Vibration Measurement Fixture was calibrated statically and dynamically, and background noise was measured with ST RWA not operating. A base line set of forces and moments of the ST RWA along and about three mutually perpendicular axes were recorded at room ambient. The temperature vibration sensitivites shown are those which were concluded to be a function of rotor unbalance changes and not associated with either spin motor nor rotor electronic changes. Author

N77-26182*# Transemantics, Inc., Washington, D.C.
MANUAL FOR ADJUSTMENT AND HANDLING OF PLATFORMS FOR DATA COLLECTION VIA SATELLITE (CDCP)
Oscar Bakir Handal Washington NASA Jun. 1977 58 p refs Transl. into ENGLISH from Manual para el ajuste y manejo de las pataformas de coleccion de datos via satellite (CDCP) (La Paz), Feb. 1977 p 1-49
(Contract NASw-2792)
(NASA-TM-75020) Avail: NTIS HC A04/MF A01 CSCL 22B

The LANDSAT and GOES data collection systems are described as well as the components of their convertible data collection platforms (CDCP). Methods are given for coding platform data, adjusting input, and operating both the LANDSAT and the GOES system. A glossary of terms is included with a bibliography. Author

N77-26183*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ON-ORBIT PERFORMANCE OF THE 12 GHz, 200 WATT TRANSMITTER EXPERIMENT PACKAGE FOR CTS
Robert E. Alexovich 1977 9 p refs Presented at Intern. Conf. on Communications, Chicago, 12-15 Jun. 1977; sponsored by IEEE
(NASA-TM-X-73636) Avail: NTIS HC A02/MF A01 CSCL 22A

Performance characteristics from on-orbit tests of the transmitter experiment package (TEP) for the Communications Technology Satellite (CTS) are presented. The TEP consists of a power processing system (PPS), an output stage tube (OST) and a variable conductance heat pipe system (VCHPS), all of which are described. Test results presented include efficiencies, RF output power, frequency response, and performance with single and multiple (two) carriers, frequency-modulated by video signals. Author

N77-26184*# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
DESIGN, CONSTRUCTION, TEST AND FIELD SUPPORT OF A CONTAINERLESS PAYLOAD PACKAGE FOR ROCKET FLIGHT Final Report
20 May 1977 16 p refs
(Contract NAS8-30797)
(NASA-CR-149997) Avail: NTIS HC A02/MF A01 CSCL 16D

The performance of a device for electromagnetically heating and positioning containerless melts during space processing was evaluated during a 360 second 0-g suborbital sounding rocket flight. Components of the electromagnetic containerless processing package (ECPP), its operation, and interface with the rocket are described along with flight and qualification tests results. A.R.H.

N77-26185# Air Force Geophysics Lab., Hanscom AFB, Mass.
SCATHA SATELLITE INSTRUMENTATION REPORT: THERMAL PLASMA ANALYZER; RAPID SCAN PARTICLE DETECTOR; ELECTRON BEAM SYSTEM; POSITIVE ION BEAM SYSTEM Air Force Surveys in Geophysics, Final
Arthur L. Pavel 10 Sep. 1976 54 p
(AD-A035506; AFGL-TR-76-0207; AFGL-AFSG-352) Avail: NTIS HC A04/MF A01 CSCL 22/2

The Air Force Geophysics Laboratory will furnish four experiments for the synchronous research satellite SCATHA Spacecraft Charging at High Altitudes scheduled for launch in 1978. These instruments include: (1) boom and surface mounted gridded probes to measure the thermal 0 to 100 eV plasma environment and the structure of the satellite photo-sheath, (2) a combination of electrostatic analyzers and solid state spectrometers to measure the plasma particle fluxes 50 eV to MeV responsible for the spacecraft charging phenomena and transient charging effects, (3) an electron beam system able to eject electrons with from 50 eV to 3 keV in energy to attempt to correct for charging caused by environmental electrons, and (4) an ion beam system able to eject ionized Xenon with 1 keV and 2.5 keV energies, to attempt to duplicate charging caused by environmental electrons. These instruments will be part of the total SCATHA instrumentation which consists of engineering and environmental definition experiments. Acting in concept, these instruments will test charge neutralizing procedures and provide data to specify design criteria for future synchronous satellites.
GRA

N77-26186# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
EVALUATION OF THE HARPOON MISSILE SHOCK ENVIRONMENT DURING EJECTION LAUNCH BY AIRCRAFT LAUNCHERS Final Report, Jul. 1973 - Nov. 1975

Allan G. Piersol Feb. 1977 43 p
(Contract N60530-75-M-5630)
(AD-A037067; BBN-2950; NWC-TP-5881) Avail: NTIS HC A03/MF A01 CSCL 16/4

A series of ground launch ejections of a Harpoon missile were performed to establish and evaluate the Harpoon ejection shock environment. The acceleration response of the missile was measured at 30 locations during various ejections from an MAU-9A/A and an Aero-7A-1 rack. The data were reduced to acceleration shock spectra covering a frequency range from 100 to 10,000 Hz. The results of the study produced considerable information concerning launch ejection shock environments of general interest. GRA

N77-26187# Brown Univ., Providence, R. I. Div. of Engineering.
MINIMUM ENERGY CONTROL OF A BILINEAR PURSUIT-EVASION SYSTEM Interim Report
Kuang-Chung Wei and Allan E. Pearson 21 Jul. 1976 35 p refs
(Grant AF-AFOSR-2793-75)
(AD-A037556; AFOSR-77-0174TR) Avail: NTIS HC A03/MF A01 CSCL 16/2

A two-dimensional missile intercept system is formulated as a bilinear pursuit-evasion problem. The minimum energy control of this problem is discussed and analyzed together with the singularly perturbed problem. It is shown that the optimal control appears in a constant form which can be solved explicitly from the boundary conditions. The terminal intercept condition can be achieved provided the area swept out by a given controller sustains a certain constant value. A least squares estimation scheme for the target speed and the relative heading is developed for the case where the target turn rate is a known constant. Author (GRA)

N77-26188# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SPECULAR REFLECTION TIMING PREDICTIONS FOR THE PERIOD PRECEDING THE 1977 VERNAL EQUINOX Project Report
Alan S. Friedman 26 Jan. 1977 33 p
(Contract F19628-76-C-0002)
(AD-A036982; ETS-8; TR-77-29) Avail: NTIS HC A03/MF A01 CSCL 22/3

With the approach of the vernal equinox, preparations for observing specular reflections from cylindrical synchronous satellites have begun. The purpose of this report is to assemble the results of preliminary computations to make them available for observation scheduling at the GEODSS Experimental Test Site. Author (GRA)

N77-26189# Sandia Labs., Albuquerque, N. Mex.
APPLICATION OF LIGHT-INITIATED EXPLOSIVE FOR SIMULATING X-RAY BLOWOFF IMPULSE EFFECTS ON A FULL SCALE REENTRY VEHICLE
R. A. Benham, F. H. Mathews, and P. B. Higgins 1976 26 p refs Presented at the 47th Shock and Vibration Symp., Albuquerque, New Mexico, 19 Oct. 1976
(Contract E(29-1)-789)
(SAND-76-9019; Conf-761062-2) Avail: NTIS HC A03/MF A01

A lateral impulse test on a full scale reentry vehicle is described which demonstrates that the light-initiated explosive technique can be extended to the lateral loading of very large systems involving load discontinuities. This experiment required the development of a diagnostic method for verifying the applied impulse, and development of a large light source for simultaneously initiating the explosive over the surface of the vehicle. Acceptable comparison between measured strain response and code predictions is obtained. The structural capability and internal response of a vehicle subjected to an X-ray environment were determined from a light-initiated explosive test. ERA

N77-26190# Engins Matra, Velizy (France).
IMPROVEMENT OF OTS ATTITUDE CONTROL (DURING STATIONKEEPING) USING A MICROPROCESSOR Final Report [AMELIORATION DU CONTROLE D'ATTITUDE DU SATELLITE OTS (PENDANT LE CONTROLE DE POSTE) PAR UTILISATION DE MICROPROCESSEUR]
Claudette Chaumontet and Daniel Goncalves [1976] 98 p In FRENCH
(N-30-472-0) Avail: NTIS HC A05/MF A01

The use of an onboard microprocessor for OTS attitude control is discussed. It is shown that attitude correction by telecommanded gas jets during short instants is not optimal. A solution is proposed based on an onboard microprocessor system. The correction principle of the system is described, and programming details are given. ESA

N77-26191# Engins Matra, Velizy (France).
OPTIMIZATION OF THE PARAMETERS OF A STELLAR SENSOR, USED FOR ATTITUDE RECONSTITUTION OF A SATELLITE [OPTIMISATION DES PARAMETRES D'UN SENSEUR STELLAIRE UTILISE POUR LA RECONSTITUTION D'ATTITUDE D'UN SATELLITE]
P. Lecchi 1976 51 p In FRENCH
(N-30-486-0) Avail: NTIS HC A04/MF A01

The configuration and types of star sensor for use onboard the Exosat satellite were studied. In arbitrary pointing mode, the satellite should observe 98% of known X-ray sources during its life, and the absolute position of weak sources should be determined with a precision of 10 arcsec. A star sensor is used for eliminating the attitude control gyro's drift. Possible star sensor configurations (parallel or angled) and two types of sensors were investigated in relation to pointing precision, number of stars in the field of view, and number of stars around the sources. ESA

N77-26192# Rocketdyne, McGregor, Tex.
PROJECT DAME: TACTICAL INSTRUMENTED MISSILE SIMULATION TESTING Final Report, Jun. 1975 - Sep. 1976
J. D. Burton Dec. 1976 173 p refs
(Contract F04611-75-C-0069)
(AD-A035600; R-4939; AFRPL-TR-76-87) Avail: NTIS HC A08/MF A01 CSCL 21/9

Results of a previous program - an instrumented modified 14-inch bomb dummy unit BDU flown on an F-111 aircraft - were applied, analytically, to an AIM-7E Sparrow Motor. An inert Sparrow motor was instrumented with accelerometers, strain and stress gages, and thermocouples. It was then subjected to thermal, dynamics, and captive-flight simulation tests that cover the expected range of loadings to be encountered in captive flight on high performance aircraft. Random vibration input control was based on BDU response during actual captive flight, which compared favorably with MIL-STD-810 C requirements at frequencies below 400 Hertz. An enhanced spectral input based on assumed response on aircraft such as an F-4 was also run. Both analysis and experiment indicate that stresses imposed on the motor from thermal changes are relatively low. Propellant characterization and aging data and gage calibration data are presented. Calibration data presented are sufficient to permit data reduction from actual captive-flight tests. GRA

N77-26193# Range Commanders Council, White Sands Missile Range, N. Mex. Range Safety Group.
PRESENTATION OF MISSILE FLIGHT INFORMATION Final Report
Mar. 1977 82 p Supersedes RSG-312-72
(AD-A037756; RSG-312-77; RSG-312-72) Avail: NTIS HC A05/MF A01 CSCL 16/1

The information presented in this document is an aid to all ranges in determining which systems may have merit for their application, provide some insight into future applications of display systems' and to determine the type of display systems currently in use at the various ranges and the data being presented to the Range Safety Officer. The Range Safety Officer will maintain surveillance during flight to insure complicance with established safety criteria. Author (GRA)

N77-26194# Communications Satellite Corp., Washington, D.C.
ANALYSIS OF THE ARPA SATELLITE CIRCUIT BETWEEN ETAM, W. VA., AND GOONHILLY, UK AND PROPOSED IMPROVEMENTS TO THE CIRCUIT DESIGN Final Report, Nov. 1975 - Nov. 1976
Stanley Rothschild 5 Jan. 1977 54 p
(Contract F44620-76-C-0045)

(AD-A037675; AFOSR-77-0210TR) Avail: NTIS HC A04/MF A01 CSCL 17/2

This report describes the work performed in support of the ARPA packet satellite experiment. Test results on the satellite circuit and the modifications incorporated into the channel modem as a result of those tests are presented. Also discussed are new interface units which can increase the information throughout by as much as 20%. New test and monitor facilities are also presented. Author (GRA)

N77-26195# Mitre Corp., Bedford, Mass.
HIGH ALTITUDE SATELLITE COMMUNICATIONS, WITH CROSSLINKS
P. F. Christopher, E. R. Edelman, and S. M. Maciorowski Jan. 1977 131 p refs
(Contract F19628-76-C-0001; AF Proj. 636B)
(AD-A037118; MTR-3161; ESD-TR-76-363) Avail: NTIS HC A07/MF A01 CSCL 17/2

Analysis and FORTRAN programs that quantitatively describe the uplink, crosslinks, and down links for a 10 satellite, two ground-station satellite communications system are described. The existence of each link (accounting for earth obstruction for crosslinks and coverage for up/downlinks), angles, ranges, and Dopplers are given as outputs of the programs listed in less than one minute central processing unit (CPU) time on a 370/158 computer. General Keplerian orbits are allowed (0 equal to or less than eccentricity equal to or less than 0.99). A new analysis is presented, which results in simple estimates of orbital stability as a function of lunar perturbations. Thus, very general satellite communication orbits (altitude range 3000 to 250,000 nautical miles) can be analyzed with little additional CPU time. GRA

N77-26196# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
THE TRANSIT SYSTEM, 1975
H. D. Black, R. E. Jenkins, and L. L. Pryor Dec. 1976 61 p refs
(Contract N00017-72-C-4401)
(AD-A037398; APL/JHU-TG-1305) Avail: NTIS HC A04/MF A01 CSCL 17/7

This report describes the development and 1975 status of the Transit System (Navy Navigation Satellite System). Transit has been available for military use since 1963 and for public use since 1967, providing all-weather navigation to world-wide users. For users on land, the system provides a standard for global surveying data. A single 15-min data span provides the necessary data for an on-land user to obtain his position with a 20- to 40-m precision. If all the data available in a 2-day period are used, then the position is good to a 1- to 5-m precision. The position is specified in a global datum system and is free of the limitations associated with local datum coordinates. At the time of this writing, five satellites were in polar orbits. The system has been continuously updated and improved with no user changes required. In late 1975, the geopotential model used for the previous 7 years was replaced by the DoD model WGS-72. The importance of the change to system users is discussed. Author (GRA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N77-26197*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF PHASE CHANGE PAINT HEAT TRANSFER TEST UTILIZING 0.040-SCALE 50% FOREBODY MODELS (NO. 82-0) OF THE ROCKWELL INTERNATIONAL SPACE SHUTTLE ORBITER IN AEDC VKF HYPERSONIC TUNNEL B (TEST OH54B)
W. H. Dye (Rockwell Intern. Corp., Downey, Calif.) May 1977 70 p refs
(Contract NAS9-13247)
(NASA-CR-151074; DMS-DR-2342) Avail: NTIS HC A04/MF A01 CSCL 20D

Aerodynamic heating phase change paint tests for the space shuttle orbiter are reported. The model was a 0.040 scale representation of the forward 50% of the orbiter. Surface roughness effects on boundary layer transition were investigated. The roughness was simulated by steel balls 0.020 and 0.025 inch in diameter and a 0.25 in. diameter hole simulating the forward ET attach socket. A nominal Mach number of was tested with unit Reynolds number varying from 0.75 x 1 million ft through 3.5x 1 million ft. Angle of attack was varied from 20 degrees to 40 degrees. Author

N77-26198*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ORBIT TRANSFER SYSTEMS WITH EMPHASIS ON SHUTTLE APPLICATIONS, 1986-1991
Apr. 1977 218 p
(NASA-TM-X-73394) Avail: NTIS HC A10/MF A01 CSCL 22A

A systems study is presented for a transportation system which will follow the interim upper stage and spinning solid upper stage. Included are concepts, concept comparisons, trends, parametric data, etc. associated with the future system. Relevant technical and programmatic information is developed. This information is intended to focus future activity to identify attractive options and to summarize the major issues associated with the future development of the system. To establish a common basis for identifying current transportation concepts, an orbit transfer vehicle (OTV) is defined as a propulsive (velocity producing) rocket or stage. When used with a crew transfer module, a manned sortie module or other payloads, the combination becomes an orbit transfer system (OTS). Standardization of OTV's and OTS's is required. Author

N77-26199*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Houston Astronautics Div.
ASSESSMENT OF RELATIVE VELOCITY AS INDEPENDENT VARIABLE FOR SPACE SHUTTLE FIRST STAGE GUIDANCE ATTITUDE COMMAND TABLES
M. Kimbrough 15 Jun. 1977 15 p refs
(Contract NAS9-14960)
(NASA-CR-151436; DN-1.4-7-57) Avail: NTIS HC A02/MF A01 CSCL 22A

The selection of relative velocity as the independent variable for the space shuttle first stage guidance attitude command tables was assessed to support the first stage guidance point design. The criterion for selecting the independent variable for first stage open loop guidance is to reduce or minimize performance dispersions, primarily those affecting structural loads. The products of angle of attack and angle of sideslip times dynamic pressure are used as load indicators, and minimizing their dispersions will indicate a minimum loads dispersion. Relative velocity is shown to be an acceptable steering independent variable. Author

N77-26200# Hercules, Inc., Magna, Utah.
SPACE SHUTTLE RESPONSE TO ACOUSTIC COMBUSTION INSTABILITY IN THE SOLID ROCKET BOOSTERS Final Report, Jun. 1975 - Jun. 1976
F. R. Jensen Jun. 1976 83 p refs
(Contract F04611-73-C-0025)
(AD-A037157; AFRPL-TR-76-62) Avail: NTIS HC A05/MF A01 CSCL 22/2

Response of the space shuttle vehicle to unstable acoustic pressure oscillations in the solid rocket boosters (SRB's) was calculated. The response was expressed in terms of forces and displacements at the attach points between the SRB's and the External Tank (ET), and between the ET and the Orbiter. The response calculations satisfied the objectives of the program. The NASTRAN computer program was used to analyze the various finite element shuttle models. Finite element models of the SRB, ET, and Orbiter were supplied by North American Rockwell. A detailed finite element model of the solid rocket motor (SRM) was constructed for use with the cyclic symmetry option in NASTRAN. The models were analyzed separately, and results were combined to represent the total structure by using a mechanical impedance-type approach. Some hand calculations were performed to estimate the axial connection point force and displacement. The good agreement between hand calculation and computer solution provided some confidence in the comput-

er solution. A maximum attach point load of 1,600 lbs was calculated for a + or - 1.0 psi pressure oscillation level. Therefore, maximum attach point loads of 16,000 to 32,000 lbs can be expected for maximum pressure oscillation levels of + or - 10 to + or - 20 psi. The attach point loads would be applied at a frequency of 15.25 Hz. GRA

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N77-26201# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen.

THE DFVLR RADIO INTERFEROMETER Final Report [DAS RADIOINTERFEROMETER DER DFVLR]

Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1976 166 p refs In GERMAN; ENGLISH summary Proc. of Colloq. held at Weilheim, West Ger., 18 Nov. 1975

(Contract BMFT-WRF-4054-I)

(BMFT-FB-W-76-25) Avail: NTIS HC A08/MF A01; ZLDI, Munich, DM 24.90

System aspects of the Weilheim radio interferometer station for satellite orbit determination are discussed. The main features of the interferometer, with its steerable antennas and pilot-monitored receiving system, are described, together with the problems which arose during the planning and erection phases of this tracking system. Topics discussed include: systems analysis, mechanical construction of the antenna rotary drive, servocontrol system, antenna design, receiver design, error analysis, computer and programming aids, and calibration. For individual titles, see N77-26202 through N77-26215.

N77-26202# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen

OUTLINE OF THE INTERFEROMETER STATION [UEBERSICHT UEBER DIE INTERFEROMETERANLAGE]

H. Goessl *In its* The DFVLR Radio Interferometer Dec. 1976 p 21-27 refs In GERMAN (For primary document see N77-26201 17-17)

Avail: NTIS HC A08/MF A01; ZLDI Munich DM 24.90

The measurement principle and the layout of the Weilheim interferometer station for satellite orbit determination are described. The interferometer operates in the 136 to 138 MHz range, and includes three steerable directional antennas, a monopulse installation, receiver and phase measurement unit, and a processor. ESA

N77-26203# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen.

SYSTEMS THEORY OF THE RADIO INTERFEROMETER [ZUR SYSTEMTHEORIE DES RADIOINTERFEROMETERS]

S. Starker *In its* The DFVLR Radio Interferometer Dec. 1976 p 28-43 refs In GERMAN (For primary document see N77-26201 17-17)

Avail: NTIS HC A08/MF A01; ZLDI Munich DM 24.90

The systems analysis background of the Weilheim interferometer is described. This analysis was split up into functional analysis, accuracy analysis, and accuracy testing, each of which represents a number of subsystems. The most important system parameters are interrelated by the basic equations for azimuth, elevation, and directional cosines. ESA

N77-26204# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.

MECHANICAL ACCURACY OF THE ANTENNA ROTARY DRIVE AND ITS TESTING [DIE MECHANISCHE GENAUIGKEIT DER ANTENNENDREHSTAENDE UND IHRE UEBERPRUEFUNG]

E. Hoermann *In its* The DFVLR Radio Interferometer Dec. 1976 p 44-52 In GERMAN (For primary document see N77-26201 17-17)

Avail: NTIS HC A08/MF A01; ZLDI Munich DM 24.90

The mechanical accuracy requirements of the radio interferometer antenna are outlined and all separate measurements in setting up and adjusting the installation are described. Accuracies obtained and problems encountered during measurement are discussed. The overall error for the mechanical subsystem is about 1.5 arc sec for interferometric angular measurements.ESA

N77-26205# Zeppelin-Metallwerke G.m.b.H., Friedrichshafen (West Germany).

CONSTRUCTION DETAILS OF THE INTERFEROMETER ROTARY DRIVE [BESONDERHEITEN BEI DER KONSTRUKTION DES INTERFEROMETERDREHSTANDES]

K. Hagenlocher *In* DFVLR The DFVLR Radio Interferometer Dec. 1976 p 53-61 In GERMAN (For primary document see N77-26201 17-17)

Avail: NTIS HC A08/MF A01; Munich DM 24.90

Details are presented on the mechanical construction of the radio interferometer antenna rotary drive, the reflector, and the drives for the azimuth and elevation movement of the antenna. ESA

N77-26206# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.

THE CONCEPT OF ANTENNA SERVOCONTROL [DAS KONZEPT DER ANTENNENNACHFUEHRUNG]

M. G. Fey *In its* The DFVLR Radio Interferometer Dec. 1976 p 62-75 refs In GERMAN (For primary document see N77-26201 17-17)

Avail: NTIS HC A08/MF A01; ZLDI Munich DM 24.90

The servocontrol system for the satellite orbit determination radio interferometer is described. The requirements on the three high gain steerable antennas are parallel alignment and exact alignment on target. The operational models, which include data from a monopulse tracking antenna, are outlined. The control system structure is detailed and operational experience is mentioned. ESA

N77-26207# AEG-Telefunken, Wedel (West Germany).

TECHNICAL DETAILS OF THE CONTROL AND DRIVE SYSTEMS [TECHNISCHE BESONDERHEITEN DES REGELUNGS- UND ANTRIEBSSYSTEMS]

W. Weitemeyer *In* DFVLR The DFVLR Radio Interferometer Dec. 1976 p 76-90 In GERMAN; ENGLISH summary (For primary document see N77-26201 17-17)

Avail: NTIS HC A08/MF A01; ZLDI Munich DM 24.90

A survey is presented of the control system for the radio interferometer antenna system. The system consists of a digital part and an analog part for various control modes. Technical details are given concerning the measurement unit, the characteristics, code converter, and linear interpolator. ESA

N77-26208# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen.

PLANNING OF THE INTERFEROMETER ANTENNA [PLANUNG DER INTERFEROMETERANTENNEN]

H. Oettl *In its* The DFVLR Radio Interferometer Dec. 1976 p 91-99 refs In GERMAN (For primary document see N77-26201 17-17)

Avail: NTIS HC A08/MF A01; ZLDI Munich DM 24.90

The design of the radio interferometer antenna for satellite orbit determination, is described. The antenna array was designed with a Chebyshev amplitude distribution in two planes and has an abnormally large sidelobe suppression of 43 dB in the main focal plane notwithstanding its small size. Multipath effects were reduced by a system of concentric scattering fences. ESA

N77-26209# Rohde and Schwartz, Munich (West Germany).

ANTENNAS AND CENTRAL HF CABLING [ANTENNEN UND ZENTRALE HF-VERKABELUNG]

L. Thomanek and H. Neubauer *In* DFVLR The DFVLR Radio Interferometer Dec. 1976 p 100-115 In GERMAN (For primary document see N77-26201 17-17)
Avail: NTIS HC A08/MF A01; ZLDI Munich DM 24.90

Technical details are presented on the antennas and the cabling for the orbit determination radio interferometer. The directional antenna array consists of 3b crossed dipoles, with an amplitude distribution according to Dolph-Chebyshev. A capacitively coupled network is used for distribution. The internal cabling consists of temperature stabilized styroflex HF cables. The central HF cables between antenna and control console, the antenna coupler, and the pressurized air supply are also dealt with. ESA

N77-26210# Bell Telephone Mfg. Co., Antwerp (Belgium).
VHF INTERFEROMETER RECEIVER SYSTEM FOR SATELLITE ORBIT DETERMINATION [VHF-INTERFEROMETER EMPFANGSSYSTEM ZUR SATELLITENBAHNVERMESSUNG]
M. Nollet *In* DFVLR The DFVLR Radio Interferometer Dec. 1976 p 116-124 refs In GERMAN (For primary document see N77-26201 17-17)
Avail: NTIS HC A08/MF A01; ZLDI Munich DM 24.90

Technical details are provided concerning the receiver of the radio interferometer for satellite orbit determination. To avoid delay deviations in the three receiver channels, use is made of a pilot signal fed in at the input of each antenna unit. The delay of cables is supervised by an electric length measurement device. Descriptions are given of this device, the angle measurement equipment, and the automatic phase control unit. ESA

N77-26211# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen.
ERROR SOURCES OF THE RECEIVER SYSTEM [FEHLERQUELLEN DER EMPFAENGERANLAGE]
D. Hounam *In its* The DFVLR Radio Interferometer Dec. 1976 p 125-134 refs In GERMAN (For primary document see N77-26201 17-17)
Avail: NTIS HC A08/MF A01; ZLDI Munich DM 24.90

The phase measurement accuracy of the orbit determination radio interferometer is discussed. This accuracy relates to the transmission path between the antenna and the central processing installation. Systematic phase errors (residual errors of nonstatistical nature) and statistical phase errors are analyzed, and their effects on accuracy are described. ESA

N77-26212 AEG-Telefunken, Ulm (West Germany).
AUTOMATIC COMPUTER CONTROLLED OPERATION OF THE INTERFEROMETER INSTALLATION [AUTOMATISCHER, RECHNERGESTEUERTER BETRIEBSABLAUF DER INTERFEROMETERANLAGE]
K. Angermueller *In* DFVLR The DFVLR Radio Interferometer Dec. 1976 p 135-139 In GERMAN (For primary document see N77-26201 17-17)
Avail: NTIS HC A08/MF A01; ZLDI Munich DM 24.90

The role of the computer within the control of the satellite orbit determination ground station is described. The computer carries out three main tasks: processing of the received data, calculation of the antenna settings, and supervision of all important station parameters. ESA

N77-26213# Siemens A.G., Munich (West Germany).
SOFTWARE SYSTEM OF THE INTERFEROMETER COMPUTER [SOFTWARE-SYSTEME DES INTERFEROMETERRECHNERS]
H. Vogl and J. Hammesfahr (DFVLR, Oberpfaffenhofen, West Ger.) *In* DFVLR The DFVLR Radio Interferometer Dec. 1976 p 140-149 In GERMAN (For primary document see N77-26201 17-17)
Avail: NTIS HC A08/MF A01; ZLDI Munich DM 24.90

The structure and function of the software system for the orbit determination radio interferometer station are described. The system was developed for calibration and operation of the interferometer. ESA

N77-26214# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen.
COMPUTERIZED DETERMINATION OF THE SATELLITE DIRECTION [RECHNERISCHE BESTIMMUNG DER SATELLITENRICHTUNG]
J. Hammesfahr *In its* The DFVLR Radio Interferometer Dec. 1976 p 150-155 In GERMAN (For primary document see N77-26201 17-17)
Avail: NTIS HC A08/MF A01; ZLDI Munich DM 24.90

The procedure for determining a satellite's direction from monopulse and interferometer antenna data is described. Three program versions were developed for computer implementation of this procedure. The three versions relate to fast passing satellites, slow passing satellites, and very slow passing or geostationary satellites. ESA

N77-26215# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen.
CALIBRATION OF THE INTERFEROMETER [DIE EICHUNG DES INTERFEROMETERS]
H. Nau *In its* The DFVLR Radio Interferometer Dec. 1976 p 156-166 refs In GERMAN (For primary document see N77-26201 17-17)
Avail: NTIS HC A08/MF A01; ZLDI Munich DM 24.90

A survey of external calibration of the satellite orbit determination interferometer system is presented. This external calibration is necessary to determine all system errors not covered by internal calibration, e.g., in the antenna system. A source of errors is the position of the antenna phase centers and their possible displacements as a function of observation direction. ESA

N77-26216# Oklahoma State Univ., Stillwater.
TRAJECTORY DETERMINATION AND TELEMETRY RECEIVING SYSTEM EVALUATION
R. Michael Fike 1 Nov. 1976 36 p refs
(Contract F19628-75-C-0084)
(AD-A037959; AFGL-TR-76-0276; Scientific-2) Avail: NTIS HC A03/MF A01 CSCL 09/6

A highly mobile, relatively inexpensive trajectory determination and telemetry receiving system has been previously developed to support sounding rocket launches at remote launch sites, where telemetry trackers and radar sets are not available. An S-band autotrack antenna system is used to provide telemetry data reception and azimuth and elevation angles to the position of the target being tracked. The tracking system is called Tratel for tracking and telemetry. The range to the target being tracked is provided by a PCM ranging system, called Tradat for trajectory data. The range from Tradat is used with the azimuth and, elevation angles from Tratel to provide the trajectory data. This report provides a trajectory evaluation of the Tratel/Tradat system for five sounding rocket flights, launched during three missions at two launch sites. The trajectory data was evaluated by comparing it with data from fixed site radar sets. Excellent quality telemetry data and autotrack azimuth and elevation data was received from all rockets in all three missions. Range data from the first two missions was excellent and range data from three of the five rockets in the third mission was good enough, with computer editing, to provide adequate trajectory data support for the mission. (The third mission was hampered by the loss of an airborne ranging receiver on one of the rockets prior to launch, and by ranging dropouts due to an improper modulation adjustment to the ranging transmitter.) This evaluation shows that the Tratel/Tradat system can provide excellent quality trajectory and telemetry support for sounding rockets launched at remote launch sites. Author (GRA)

N77-26217# PRC Information Sciences Co., Rome, N.Y.
SPACE SURVEILLANCE SOFTWARE SUPPORT. VOLUME 1, PART 1, BOOK 3: COMPUTER PROGRAM DOCUMENTATION Final Technical Report, Apr. 1975 - Jul. 1976
P. Richard Conti Oct. 1976 88 p refs
(Contract F30602-75-C-0167; AF Proj. 6512)
(AD-A033658; RADC-TR-76-261-Vol-1-Pt-1-Bk-3) Avail: NTIS HC A05/MF A01 CSCL 15/3

Several computer programs were developed to perform the auxiliary function of punching out data files so that plots could

be generated on the Hewlett-Packard 9820A calculator/plotter. radar coverage parameters were computed and placed on a file by any one of three trajectory-type programs, the RADC Trajectory Program, the COBRA TALON Trajectory Program, or the Orbit Prediction Program. A listing of the source code, a sample job stream, and sample output for each of the auxiliary programs follow. The sample output represents a portion of the printout from the execution of each program. The first set of listing, job stream, and output is given for the program to punch out the RADC Trajectory Program plot file, the second set is for the COBRA TALON punch program, and the third for the Orbit Prediction punch program. GRA

N77-26218# Range Commanders Council, White Sands Missile Range, N. Mex. Electronic Trajectory Measurements Group.
LOW-ALTITUDE TRACKING DEVELOPMENT PLAN Final Report
Jun. 1976 40 p
(AD-A037593) Avail: NTIS HC A03/MF A01 CSCL 17/9

This report is the result of a coordinated effort geared to assure that the Low-Altitude Tracking Development Plan: (1) fulfills the needs of most ranges and (2) insures that duplication of effort will not occur. Author (GRA)

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N77-26219# Dornier-System G.m.b.H., Friedrichshafen (West Germany).
STUDY ON THE FEASIBILITY OF STRUCTURAL THERMAL CANISTER FOR THE INSTRUMENT POINTING SUB-SYSTEM OF THE SPACELAB, VOLUME 1 Final Report
U. Hoppe, H. Kreeb, H. Nickel, F. D. Heidt, H. Staatsmann, H. Koch, and M. Perdu Feb. 1977 256 p refs 2 Vol.
(Contract ESA-2817/76/P/WMT(SC))
(ESA-CR(P)-922-Vol-1) Avail: NTIS HC A12/MF A01

A canister was studied for the precision pointing facility IPS (used for Spacelab Experiments). This canister has to provide a mounting and thermally controlled environment for a set of individually not controlled experiments. Due to the high pointing precision of 0.2 arcsec required by NASA for Spacelab it may be necessary to design the structural canister in graphite epoxy. Four different solutions were evaluated and compared for the thermal canister: a fluid loop system, a heater-radiator system, a varable conductance heat pipe radiator system, and a vapor chamber system. The fluid loop system and the variable conductance heat pipe radiator meet specifications; but the heat pipe system was selected due to the shorter delivery time, lower weight, lower power consumption, and available European state of the art (many parts of the fluid loop system are delivered only by US suppliers). A detailed thermal and structural analysis was carried out for the selected system. Author (ESA)

N77-26220# Dornier-System G.m.b.H., Friedrichshafen (West Germany).
STUDY ON THE FEASIBILITY OF STRUCTURAL THERMAL CANISTER FOR THE INSTRUMENT POINTING SUB-SYSTEM OF THE SPACELAB, VOLUME 2 Final Report
U. Hoppe, H. Kreeb, H. Nickel, F. D. Heidt, H. Staatsmann, H. Koch, and M. Perdu Feb. 1977 44 p 2 Vol.
(Contract ESA-2817/76/P/WMT(SC))
(ESA-CR(P)-922-Vol-2) Avail: NTIS HC A03/MF A01

A canister was studied for the precision pointing facility IPS (used for Spacelab experiments). This canister has to provide a mounting and thermally controlled environment for a set of individually not controlled experiments. A cost evaluation is given for the total canister as well as for the thermal and structural subsystems, based on the heat pipe radiator solution selected. ESA

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N77-26221* Rocketdyne, Canoga Park, Calif.
ADVANCED THRUST CHAMBER TECHNOLOGY Final Report, Jan. 1974 - Aug. 1976
M. C. Yost, H. E. Marker, and P. C. Dennies 5 Jul. 1977 298 p refs
(Contract NAS3-17825)
(NASA-CR-135221; R76-116) Avail: Issuing Activity CSCL 21H

Base technology was developed for a high performance, high expansion area ratio nozzle, liquid hydrogen cooled thrust chamber assembly for a staged combustion cycle rocket engine. The components required for high area ratio thrust chamber assembly (400:1), including injector, combustor, 175.1 area ratio intermediate nozzle and dump cooled, 400:1 nozzle were designed, fabricated and tested. Testing at area ratios of 175:1 and 400:1 was conducted at simulated altitude conditions utilizing a self pumping diffuser and a gaseous nitrogen ejector; tests at 8:1 area ratio were at sea level conditions. Diffuser/ejector operation was successful at 175:1 but inadequate start margin at 400:1 area ratio resulted in a non-pumping condition. Specific impulse performance was obtained for 8:1 and 175:1 area ratio testing and met analytical predictions. Projections to higher area ratios also met analytical predictions. Author

N77-26222*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOLAR ARRAY MAXIMUM POWER TRACKING WITH CLOSED-LOOP CONTROL OF A 30-CENTIMETER ION THRUSTER
R. P. Gruber Mar. 1977 25 p refs
(NASA-TM-X-73643; E-9148) Avail: NTIS HC A02/MF A01 CSCL 21C

A new solar array/ion thruster system control concept has been developed and demonstrated. An ion thruster beam load is used to automatically and continuously operate an unregulated solar array at its maximum power point independent of variations in solar array voltage and current. Preliminary tests were run which verified that this method of control can be implemented with a few, physically small, signal level components dissipating less than two watts. Author

N77-26223 European Space Agency, Paris (France).
FIELD EMISSION DAY
Jan. 1977 148 p refs Proc. of a Meeting held at ESTEC, Noordwijk, Neth., 9 Apr. 1976
(ESA-SP-119) Avail: NTIS HC A07/MF A01

Papers delivered by contractors, ESTEC staff, and research workers, on projects carried out either on ESA-sponsored studies or under national programs, and the latest results obtained at ESTEC up to the end of 1976 are reported. The topics covered

are ion field emission, emitter manufacturer and testing facilities, experimental results, a historical review, and future perspectives. For individual titles, see N77-26224 through N77-26233.

N77-26224# European Space Research and Technology Center, Noordwijk (Netherlands).
REVIEW OF PAST AND PRESENT RESEARCH STUDIES ON ION FIELD EMISSION
C. Bartoli *In* ESA Field Emission Day Jan. 1977 p 1-9 (For primary document see N77-26223 17-20)
Avail: NTIS HC A07/MF A01

Progress made in Europe in the last four years in research and testing of field emission modes is reviewed along with the current work sponsored by ESA (ion optics study, cleaning and feeding systems) and possible areas of future investigations. ESA

N77-26225# European Space Research and Technology Center, Noordwijk (Netherlands).
THE ESTEC ELECTRIC PROPULSION TEST FACILITY
H. J. HerhudtvonRohden *In* ESA Field Emission Day Jan. 1977 p 11-21 (For primary document see N77-26223 17-20)
Avail: NTIS HC A07/MF A01

The ESTEC facility for testing European field emission thrustor models is described along with the used experimental cesium thrustor model. A list of the diagnostics which were used is shown. It includes thrust and mass consumption measurements, emitted ion beam linear distribution measurements, and some tests carried out to check the influence of the background on the emission parameters and, particularly, on the thrust. Future direct thrust tests with improved optical observation systems are mentioned. ESA

N77-26226# United Kingdom Atomic Energy Authority, Culham (England).
MECHANISMS OF ION EMISSION FROM LIQUID CESIUM
K. L. Aitken *In* ESA Field Emission Day Jan. 1977 p 23-39 refs (For primary document see N77-26223 17-20)
Avail: NTIS HC A07/MF A01

The results of a series of experiments designed to find the optimum size of sharpened wires used as single emitting sites for the field ionization of liquid cesium are briefly described. The experiments were made in order to better understand the basic emission processes with a view to predicting the necessary or possible forms of a practical working ion thrustor and to compare wire emission with Taylor cone emission. The current-voltage relationship and angular distribution of the ion beam are discussed. It is argued that, on the present evidence, field emission is aided by electron impact ionization in a region above the liquid surface, transitional to the vapor phase, in order to account for the ion current. The temperature of the emitting region is discussed and shown to be much above the melting-point; neutral evaporation may therefore constitute a considerable fraction of the total throughput. Author (ESA)

N77-26227# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
EXPERIMENTS WITH FIELD EMISSION ION SOURCES
E. LeGrives and J. Labbe *In* ESA Field Emission Day Jan. 1977 p 41-52 (For primary document see N77-26223 17-20)
Avail: NTIS HC A07/MF A01

Results are given of experiments on some of the arrays elaborated by the Fulmer Institute in order to analyze the electrical performance of this type of field emission ion source. The arrays so far tested have various needle geometries with a radius of curvature at the tip ranging from 1 to 10 micron and a density of needles in the linear arrays ranging from 10 to 100 cm. Nickel and tungsten needles were tested. Experiments include the overall control of the ion beam uniformity and the measurement of ion current density and of the local neutral fraction in the whole field of interest. Author (ESA)

N77-26228# United Kingdom Atomic Energy Authority, Culham (England).
A COMPUTER CODE FOR THRUSTOR ION OPTICS
C. L. Thomas *In* ESA Field Emission Day Jan. 1977 p 53-65 refs (For primary document see N77-26223 17-20)
Avail: NTIS HC A07/MF A01

Thrustor ion optics can be studied theoretically by using numerical techniques on a digital computer. A two-dimensional computer code for the calculation of ion trajectories with space charge for line and single tip emitters was developed. The numerical methods used in the code are described and the code is shown to be numerically stable. Two examples which demonstrate the correct modelling of the physics of ion optics are given. Author (ESA)

N77-26229# United Kingdom Atomic Energy Authority, Culham (England).
COMPUTED ION TRAJECTORIES IN THRUSTOR BEAMS
P. F. Little *In* ESA Field Emission Day Jan. 1977 p 67-74 refs (For primary document see N77-26223 17-20)
Avail: NTIS HC A07/MF A01

The code developed for a point source of ions was applied to a particular experimental configuration, and initial conditions which lead to agreement with the observed distribution of trajectories were derived. Variations of the electrode configuration and potentials within the thrustor were made to improve beam transmission through the accelerating electrode system. The electrode configuration around the emitter is important for the determination of the initial ion trajectories. Recessing the emitter or providing a focusing electrode near the emitter at a potential close to the emitter potentials seems a promising design principle for producing efficient thrustors. Author (ESA)

N77-26230# Wien Univ. (Austria). Inst. of Industrial Electronics.
STABILITY AND THERMAL EFFECTS OF FIELD ION EMITTERS
J. Mitterauer *In* ESA Field Emission Day Jan. 1977 p 75-86 refs (For primary document see N77-26223 17-20)
Avail: NTIS HC A07/MF A01

In order to analyze the stability of a field ion emitter, the interaction of the different parameters may be described by means of a physical model, connecting the relevant physical processes by closed feedback loops in analogy to methods of control theory. The quantitative treatment of such a physical model is by means of computer simulation, incorporating the equations describing the physical processes. Analyzing the complexity of the physical models of both field-electron and field-ion emitters and considering the results obtained hitherto for the first case, some conclusions are drawn. ESA

N77-26231# Southampton Univ. (England). Dept. of Electronics.
FIELD EMISSION STUDY
A. G. Bailey *In* ESA Field Emission Day Jan. 1977 p 87-99 (For primary document see N77-26223 17-20)
Avail: NTIS HC A07/MF A01

A broad view of field-emission related work is presented. The three topics briefly reviewed are: conventional field emission of electrons and field ionization of ions using sharp nonmolten metallic points, and field emission of metallic absorbates; field emission studies from the liquid metal, gallium-indium; and electrostatic disruption of mercury. Author (ESA)

N77-26232# Fulmer Research Inst. Ltd., Stoke Poges (England).
MANUFACTURING OF FIELD EMITTERS
D. Stewart and R. Parkes *In* ESA Field Emission Day Jan. 1977 p 101-114 ref (For primary document see N77-26223 17-20)
Avail: NTIS HC A07/MF A01

Linear arrays of fine points for use as emitting edges in a cesium field emission thrustor were manufactured. These arrays could then be used in a cesium field emitting assembly to optimize the ideal point density, tip radius, and materials used in their manufacture. The materials used were nickel and tungsten. Point densities between 10 and 250 / cm were obtained with tip radii ranging from 0.1 to 50 micron. Author (ESA)

N77-26233# European Space Research and Technology Center, Noordwijk (Netherlands).
RECENT RESULTS OF TESTS OF EXPERIMENTAL CESIUM FIELD EMITTERS WITH THE ESTEC ELECTRIC PROPULSION TEST FACILITY
C. Bartoli and H. J. HerhudtvonRohden *In* ESA Field Emission Day Jan. 1977 p 117-141 (For primary document see

N77-26223 17-20)
Avail: NTIS HC A07/MF A01

Main modifications introduced into the ESTEC test facility and in the thrustor and ion optics design are described. The results achieved through several tests are presented. Areas which require additional improvements, which will be the short-term goals of testing at ESTEC, are briefly summarized. ESA

N77-26234# Booz-Allen and Hamilton, Inc., Bethesda, Md.
RELIABILITY ESTIMATING PROCEDURES FOR ELECTRIC AND THERMOCHEMICAL PROPULSION SYSTEMS, VOLUME 1 Final Report, Mar. 1975 - Dec. 1976
Feb. 1977 298 p
(Contract F04611-75-C-0039)
(AD-A037745; BAAR-9006-085-1-Vol-1; AFRPL-TR-76-99-Vol-1) Avail: NTIS HC A13/MF A01 CSCL 21/3

The primary objective of this study was to develop a sound standardized basis for reliability comparisons of thermochemical and electric propulsion concepts applicable to Air Force satellite, spacecraft, and upper-stage mission requirements. A corollary objective was the identification of those propulsion system components which are currently the major contributors to propulsion system failures. Nearly one hundred component level and failure mode level models were developed in the course of the study. Inherent in the reliability modeling was a quantitative assessment of the uncertainty associated with each estimate. System level assessments were performed using functionally oriented fault trees. The functional approach was used to yield fault trees that are least affected by changes and revisions at the component level. System assessments were performed by aggregating the component reliability and uncertainty results through the fault tree logic using computer programs and approximation techniques which were modified or developed for this purpose. GRA

N77-26235# Booz-Allen and Hamilton, Inc., Bethesda, Md.
RELIABILITY ESTIMATING PROCEDURES FOR ELECTRIC AND THERMOCHEMICAL PROPULSION SYSTEMS, VOLUME 2 Final Report, Mar. 1975 - Dec. 1976
Feb. 1977 279 p refs
(Contract F04611-75-C-0039)
(AD-A037748; BAAR-9006-085-1-Vol-2; AFRPL-TR-76-99-Vol-2) Avail: NTIS HC A13/MF A01 CSCL 21/3

A family of computer programs provides the capability to examine life and uncertainty distributions at levels ranging from a specific failure mode of an individual device to a complete system of substantial complexity. All of the programs were written in the BASIC language (as implemented on the CDC Cybernet/Kronos time sharing system) in order to provide interactive-mode capabilities. GRA

N77-26236# Fairchild Republic Co., Farmingdale, N.Y.
PULSED PLASMA PLUME STUDIES Final Report, Mar. 1975 - Nov. 1976
William J. Guman and Martin Begun Mar. 1977 102 p refs
(Contract F04611-75-C-0037)
(AD-A036904; AFRPL-TR-77-2) Avail: NTIS HC A06/MF A01 CSCL 21/3

The exhaust plume of a millipound thrust level pulsed plasma thruster was studied in a vacuum chamber having all walls cooled by liquid nitrogen. This thruster has a propulsive performance capable of meeting North-South station-keeping requirements of satellites. The major source of contamination of a surface located in the facility was identified to be mainly due to mass being scattered off the walls of the test facility because the walls were incapable of absorbing the highly energetic plume of the first encounter with the wall. By means of a Langmuir probe, calorimetric discs, a collimated QCM and collimated glass capture cups it was found that the transient plume is fairly well collimated and that the outer extremities of the plume are located within + or - 30 degrees to + or - 40 degrees with respect to the geometric center line of the thruster that was studied. Whether or not major changes of the exhaust cone would change this location was not examined. Time resolved studies of the plume by a Langmuir probe and a photocell has shown the life of the plume at a region in space to be only a few tens of microseconds. This result reveals that a spacecraft surface exposed over a 5 to 7 year period to the plume of a North-South station keeping thruster will actually see an accumulated plume flow time for only about 5 minutes during that mission time. GRA

N77-26237# Rocketdyne, McGregor, Tex.
AIR LAUNCH INSTRUMENTED VEHICLES EVALUATION (ALIVE) Final Report, Jan. 1974 - Dec. 1976
J. D. Burton Feb. 1977 232 p refs
(Contract F04611-74-C-0009)
(AD-A037102; R-4939; AFRPL-TR-76-101) Avail: NTIS HC A11/MF A01 CSCL 21/9

This report presents results of a program conducted to evaluate the effects of air-launch missile environments on the aging characteristics of advanced HTPB propellants and representative motor designs incorporating these propellants. The study addressed aging of two 12-inch-diameter, SRBDM-type motors cast with moderate-burning-rate propellant. The propellant was characterized, service-life loads were evaluated, and the motors were analyzed and subjected to accelerated storage and simulated captive-flight environmental testing. Carton propellant from the same batch from which the motors were cast was aged in the laboratory. Subsequently, aging characteristics of the propellant were determined from motor response and the motor design and test methods were evaluated. The motors, instrumentation, and tests are described; and test results are presented. Test results indicate: characteristics of the propellant tested change very slowly over a period from 6 months to 5 years after cast; the grain configuration tested is structurally adequate to withstand at least 5 years of use in the tactical air-launch environment; current analytical techniques are adequate; and the ALIVE approach to accelerated service-life simulation is feasible and can be made reasonably accurate. Author (GRA)

N77-26238# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
EXPERIMENTAL RESULTS FOR HYDROCARBON EXHAUST INFRARED MODEL VERIFICATION Final Report, Jul. 1975 - Mar. 1976
William J. Rothschild and Charles W. Martin Jul. 1976 127 p refs
(AD-A037252; AFATL-TR-76-74) Avail: NTIS HC A07/MF A01 CSCL 17/5

The objective of this effort was to evaluate a number of computer models used to predict infrared characteristics of hydrocarbon exhaust plumes. This report contains the experimental results obtained. Controlled plumes were generated using a small rocket operating at approximately 4 atmosphere chamber pressure and 5 grams per second total mass flow rate, exhausting into a large chamber held at 13.1 kilometers, static altitude conditions. Two liquid and two gaseous fuels were burned with gaseous oxygen at mixture ratios from 1.2 to 8.4. Engine performance was monitored with respect to combustion efficiency. Plume spatial radiation distributions were measured normal to the exhaust centerline by a scanning radiometer operating in the 4.1- to 5.1-micrometer band. Plume spectral radiation distributions were measured in a spot on the plume centerline by an interferometer spectrometer operating in the 2- to 5-micrometer region. These results show that the degree of plume afterburning with the ambient air is the dominant factor controlling hydrocarbon exhaust infrared intensity in the 4.0- to 5.5-micrometer band. Mixture ratio, combustion efficiency, and propellant composition are the key parameters affecting plume afterburning processes. These data should provide a good basis for comparison with predicted results over a sufficiently broad range of conditions to allow thorough model verification and identification of model deficiencies. Author (GRA)

N77-26239# Remtech, Inc., Huntsville, Ala.
A COMPUTER PROGRAM FOR THE PREDICTION OF RADIATION FROM ROCKET EXHAUST PLUMES, VOLUME 1
John E. Reardon 31 May 1973 91 p refs
(Contract DAAH01-73-C-0252)
(AD-A037385; RTR-013-1-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 17/5

This report describes a program for predicting infrared radiation from rocket exhaust gases to a point using a statistical band

model with a wavenumber interval of 1/25 cm. Absorption coefficient data for water vapor, carbon dioxide, carbon monoxide, hydrogen chloride, hydrogen fluoride, and soot (carbon particles) are included in the program data statements. Provision has been made for the future addition of one additional radiating species. Input for the program is gas property data (temperature, pressure, and constituent mole fractions) in either an axisymmetric or three-dimensional cylindrical coordinate system. The program can integrate the radiation from the gas to a point to provide overall radiation as well as spectral distribution of radiation at intervals of 1/25 cm. In addition, detailed optical data can be provided at each spectral interval when only a single line of sight through the gas is considered. Author (GRA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N77-26240*# Kanner (Leo) Associates, Redwood City, Calif.
THE MANIFESTATION OF THE KINETIC ISOTOPE EFFECT DURING THE DECOMPOSITION OF ORGANIC MACROMOLECULES
E. M. Galimov Washington NASA Jun. 1977 11 p refs Transl. into ENGLISH from Zh. Fiz. Khimii (USSR), v. 48, no. 6, 1974 p 1381-1385
(Contract NASw-2790)
(NASA-TT-F-17450) Avail: NTIS HC A02/MF A01 CSCL 07C

The decomposition of humified organic matter is accompanied by a depression of the kinetic effect. The hypothesis that this phenomenon is caused by a wide band of activation energies is investigated. Examination of a multilayer decomposition model corresponding to this case reveals that the isotope fractionation is significantly smaller than the isotope fractionation in the case of a monolayer model corresponding to the dissociation of simple organic compounds. The degree of depression depends on the width of the activation energy band. Author

24 COMPOSITE MATERIALS

Includes laminates.

N77-26241*# Southwest Research Inst., San Antonio, Tex. Dept. of Materials Sciences.
BIAXIAL FATIGUE LOADING OF NOTCHED COMPOSITES Final Technical Report, 9 Jun. 1975 - 24 Jun. 1977
P. H. Francis, D. E. Walrath, D. F. Sims, and D. N. Weed 24 Jun. 1977 104 p refs
(Contract NAS1-13956)
(NASA-CR-145198; SwRI-02-4275) Avail: NTIS HC A06/MF A01 CSCL 11D

Thin walled, 2.54-cm (1-in.) diameter tubular specimens of T300/934 graphite/epoxy were fabricated and fatigue cycled in combinations of axial, torsional, and internal pressure loading. Two different four-ply layup configurations were tested: (0/90)S and (+ or - 45)S; all tubes contained a 0.48-cm (3/16-in.) diameter circular hole penetrating one wall midway along the tube length. S-N curves were developed to characterize fatigue behavior under pure axial, torsional, or internal pressure loading, as well as combined loading fatigue. A theory was developed based on the Hill plane stress model which enabled the S-N curve for combined stress states to be predicted from the S-N data for the uniaxial loading modes. Correlation of the theory with the experimental data proved to be remarkably good. Author

N77-26242*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPOSITE SANDWICH LATTICE STRUCTURE Patent Application
Marvin D. Rhodes and Martin M. Mikulas, Jr., inventors (to NASA) Filed 20 May 1977 20 p
(NASA-Case-LAR-11898-2; US-Patent-Appl-SN-799024) Avail: NTIS HC A02/MF A01 CSCL 11D

A lattice type structural panel is described which uses the unidirectional character of filamentary epoxy impregnated composites to produce stiff lightweight structural panels. Strips of prepreg composite tape of the exact width of the lattice network of a honeycomb core are temperature cured to bond the strips into a unitary panel structure with the core. The total mass of the panel may be increased by varying the width of the structural rows of cells making up the lattice network. Such panels may be used in fabricating large area panels for satellites. NASA

N77-26243# Auburn Univ., Ala. Engineering Experiment Station.
TECHNIQUES FOR FLAW DETECTION IN COMPOSITE MATERIAL STRUCTURES Final Report, Dec. 1975 - Dec. 1976
W. F. Ranson and W. F. Swinson Dec. 1976 76 p ref
(Contract DAAH01-76-C-0467)
(AD-A036026; ME-AMC-0467) Avail: NTIS HC A05/MF A01 CSCL 11/4

This study concerns the nondestructive detection and quantification of flaws and voids in thin, cylindrical, fiber reinforced, composite, structures. Three types of flaws were investigated using shearing speckle and single beam speckle interferometry. The theory for each technique and photographs of the fringe patterns are presented. The Young's fringe method of speckle interferometry was used to determine the surface strains in the flaw region and the resulting flaw geometry was presented in graphical form. Shearing speckle interferometry was developed for a qualitative analysis only. The results show that flaws in their fiber reinforced composite structures can be detected and the size determined by either speckle or single beam speckle interferometry. GRA

N77-26244# Tel-Aviv Univ. (Israel). School of Engineering.
AN EXPERIMENTAL METHOD TO PRODUCE UNIFORM PLANE STRESS STATES WITH APPLICATION TO FIBER REINFORCED MATERIALS Interim Report
M. Arcan, Z. Hashin, and A. Voloshin Oct. 1976 26 p refs
(Grant AF-AFOSR-3014-76; AF Proj. 9782)
(AD-A037979; TAU-SOE/365-76; AFOSR-77-0322TR; Scientific-2) Avail: NTIS HC A03/MF A01 CSCL 11/4

This work is concerned with a new method for testing material properties under uniform plane stress conditions by means of specially designed plane specimen. Photoelastic analysis showed that in the significant section of the specimen it is possible to produce uniform plane stress with high accuracy subject to the limitation that the principal stresses are of different signs. An important special case of loading produces shear on the significant section. The method is of particular importance for fiber composite testing. Preliminary experimental results presented are encouraging. Author (GRA)

N77-26245# Army Natick Research and Development Command, Mass.
THERMAL DEGRADATION STUDIES OF FIBERS AND COMPOSITE BASE MATERIALS Final Report
M. L. Bazinet, C. DiPietro, and C. Merritt, Jr. Nov. 1976 28 p refs
(AD-A037604; NATICK/TR-77/007) Avail: NTIS HC A03/MF A01 CSCL 11/4

Data are required on the thermal degradation properties of certain polymeric substances being considered for various material applications. This report describes the development and utilization of some specialized analytical techniques and the results obtained in analysis of certain materials. The polymer systems studied included carbon fibers, kevlar fibers, weathered and unweathered specimens of scotchply 1009-26 composite systems, modified and unmodified 3M SP 250 glass fiber composites, and Reliabond 7250 glass fiber composites. The analysis sequence involved the use of a pyrolysis device to form the decomposition products, and gas chromatography for their collection and separation. The volatile decomposition products were identified by mass spectrometry. Author (GRA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N77-26246 British Library Lending Div., Boston Spa (England).
THE DETERMINATION OF THE MOLECULAR WEIGHT DISTRIBUTION OF POLYMERS BY PERMEATION CHROMATOGRAPHY ON POROUS GLASS. 1: DEXTRANS UP TO A MOLECULAR WEIGHT OF 600000
A. M. Basedow, K. H. Ebert, H. Ederer, and H. Hunger [1976] 19 p Transl. into ENGLISH from Makromol. Chem. (Basel), v. 177, 1976 p 1501-1524
(BLL-M-24884-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Prerequesites for exclusion chromatography on porous media are discussed. A method is described for using permeation chromatography on glass to separate dextran mixtures according to their molecular weights in such a way that accurate weight distributions and mean molecular weight values are calculated from the elusion curves. A normal gel chromatographic apparatus was used. The separation medium was composed of a mixture of 7 types of controlled pore glass (CPG -10) having different diameters. Fifteen narrow range dextran fractions were prepared using a 0.5% NaCl solution as the elution medium. A.R.H.

N77-26247 Materials Research Labs., Maribyrnong (Australia).
XRF ANALYSIS OF SOME REGENERATED CATALYSTS
W. B. Searle Oct. 1976 30 p refs
(MRL-TN-388; AR-282) Copyright. Avail: Issuing Activity

A grinding-briquetting technique was developed for the preparation of samples of regenerated petroleum cracking catalysts to provide rapid, accurate analysis of contaminants. The trace elements vanadium, chromium, iron, nickel, copper, zinc, lead, the rare earths, lanthanum, cerium, neodymium, may all be determined on the one sample. A more informative empirical formula for evaluating the level of trace metal contamination in regenerated stock is proposed. Author

N77-26248*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ABSOLUTE RATE CONSTANT FOR THE REACTION OF ATOMIC CHLORINE WITH HYDROGEN PEROXIDE VAPOR OVER THE TEMPERATURE RANGE 265-400 K
J. V. Michael, D. A. Whytock (Essex Univ., Colchester), J. H. Lee, W. A. Payne, and L. J. Stief May 1977 20 p refs
(NASA-TM-X-71340; X-691-77-134) Avail: NTIS HC A02/MF A01 CSCL 07D

Rate constants for the reaction of atomic chlorine with hydrogen peroxide were measured from 265-400 K using the flash photolysis-resonance fluorescence technique. Analytical techniques were developed to measure [H2O2] under reaction conditions. Due to ambiguity in the interpretation of the analytical results, the data combine to give two equally acceptable representations of the temperature dependence. The results are compared to previous work at 298 K and are theoretically discussed in terms of the mechanism of the reaction. Additional experiments on the H + H2O2 reaction at 298 and 359 K are compared with earlier results from this laboratory and give a slightly revised bimolecular rate constant. Author

N77-26249# Battelle Pacific Northwest Labs., Richland, Wash.
USE OF X-RAY SCATTERING IN ABSORPTION CORRECTIONS FOR X-RAY FLUORESCENCE ANALYSIS OF LOADED FILTERS
K. K. Nielson and S. R. Garcia Sep. 1976 15 p refs Presented at 25th Ann. Conf. on Appl. of X-ray Analysis, Denver, 25 Sep. 1976
(Contract E(45-1)-1830)
(BNWL-SA-5755; Conf-760959-1) Avail: NTIS HC A02/MF A01

Two methods are described for computing multielement X-ray absorption corrections for aerosol samples collected in IPC-1478 and Whatman 41 filters. The first relies on scatter peak intensities and scattering cross sections to estimate the mass of light elements (Z less than 14) in the sample. This mass is used with the measured heavy element (Z greater than or equal to 14) masses to iteratively compute sample absorption corrections. The second method utilizes a linear function of 1n(mu) vs 1n(E) determined from the scatter peak ratios and estimates sample mass from the scatter peak intensities. Both methods assume a homogeneous depth distribution of aerosol in a fraction of the front of the filters, and the assumption is evaluated with respect to an exponential aerosol depth distribution. Penetration depths for various real, synthethic and liquid aerosols were measured. Aerosol penetration appeared constant over a 1.1 mg/sq cm range of sample loading for IPC filters, while absorption corrections for Si and S varied by a factor of two over the same loading range. ERA

N77-26250# Sandia Labs., Albuquerque, N. Mex. Combustion Application Div.
UNSTEADY FLOW AND FLAME PROPAGATION IN A PRECHAMBER OF A STRATIFIED CHARGE ENGINE
H. A. Dwyer and B. R. Sanders Oct. 1976 9 p refs Presented at the Institution of Mechanical Engineers Intern. Conf. on Stratified Charge Engines, London, 23-25 Nov. 1976
(Contract E(29-1)-789)
(SAND-75-8743; Conf-761142-1) Avail: NTIS HC A02/MF A01

The model allows for a detailed description of finite rate chemical kinetics and flame propagation, as well as the time development of the ignition process. The numerical method of solution of the model's equations allows for a resolution of the acoustic, chemical, and diffusional time scales in the problem. For all the cases considered, a gas dynamic interaction occurs between the ignition process and flame propagation. This interaction is responsible for unsteady choking and unexpected pressure distributions in the prechamber. During the combustion process, the flame seems to displace mass much like a piston, and large amounts of unburned fuel are emitted from the prechamber. ERA

N77-26251# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
NONEQUILIBRIUM PHOTOCHEMICAL REACTIONS INDUCED BY LASERS
J. I. Steinfeld Oct. 1976 97 p refs
(Contract EY-76-S-02-2793)
(MIT-2793-5) Avail: NTIS HC A05/MF A01

The first two sections describe progress in the analysis of anharmonically split vibrational levels of octahedral hexafluorides. Results to date on the experimental identification of transient absorbing states in SF6 by double resonance spectroscopy are described. Conclusions regarding the potential of laser-driven thermal diffusion are given, and a new type of multiple infrared photon dissociation (in vinyl chloride) is described. ERA

N77-26252# McElroy (Ralph) Co., Austin, Tex.
ELECTROCHEMICAL THEORY OF CATALYSIS IN METALS
P. T. Merenkov, M. N. Nabiev, and A. P. Merenkov 1976 9 p refs Transl. into ENGLISH from Uzb. Khim. Zh. (Tashkent, USSR), no. 1, 1976 p 15-18 Sponsored by ERDA Prepared for Lawrence Livermore Lab.
(UCRL-Trans-11186) Avail: NTIS HC A02/MF A01

Previous thermodynamic calculations of the emf for NH3 synthesis in the N2-H2 combustion unit were experimentally verified with the combustion taking place over an iron oxide substrate. The solid electrolyte used was a disk of asbestos paper fiber glass impregnated with KOH. The combustion took place at atmospheric pressure and a temperature of 500 deg. The emf was measured, the voltampere curve was plotted, and the ammonia found in the nitrogen was determined. The current density for the electrodes of the catalytic microcombustion units was calculated in accordance with the theoretical principles of the electrochemical theory of catalysis in metals. ERA

N77-26253# Sandia Labs., Livermore, Calif.
COMBUSTION RESEARCH AT SANDIA LABORATORIES
Oct. 1976 28 p refs Presented at ERDA Contractors' Coordination Meeting, Ann Arbor, Mich., 18 Oct. 1976

(Contract E(29-1)-789)
(SAND-76-8511) Avail: NTIS HC A03/MF A01

Combustion research with respect to internal combustion engines is illustrated graphically. ERA

N77-26254# Brookhaven National Lab., Upton, N.Y.
QUENCHED FLAMES WITH INHIBITORS: A THEORETICAL ANALYSIS (THEORETICAL ANALYSIS OF QUENCHED FLAMES)
C. R. Krishna, C. R. Prasad, and R. B. Klemm 1976 24 p refs Presented at the 1976 Fall Tech. Meeting of the Eastern Section of the Combustion Inst., Philadelphia, 18 Nov. 1976
(Contract EY-76-C-02-0016)
(BNL-21977; Conf-761137-2) Avail: NTIS HC A02/MF A01

A simple non-adiabatic, premixed flame model was developed to represent flat-flames sitting above a cooled burner. Chemical reactions were represented by single-step Arrhenius kinetics in one-dimensional flame equations. The boundary conditions included heat loss to the burner. The multiple eigen value problem was solved numerically. Some experimental results for methane-air flames on such burners were simulated with good agreement. The computations were extended to represent methyl bromide inhibited flames; in this case, however, simulation of the experimental results required a change in the activation energy proportional to the inhibitor concentration. Extinction conditions were computed for clean and inhibited flames by increasing the amounts of inert nitrogen and inhibitor respectively. ERA

N77-26255# California Univ., Livermore. Lawrence Livermore Lab.
INVESTIGATION OF THE RELATIONSHIP BETWEEN QUASI-GLOBAL AND DETAILED KINETICS MECHANISMS FOR THE COMBUSTION OF METHANE
John R. Creighton 12 Nov. 1976 15 p refs Presented at the Eastern Section of the Combustion Inst. Meeting, Philadelphia, 18 Nov. 1976
(Contract W-7405-eng-48)
(UCRL-78424; Conf-761137-1) Avail: NTIS HC A02/MF A01

A quasi-global model for the induction time in methane combustion was developed by analyzing the results of calculations with a detailed chemical kinetics model. Good agreement with experiment is found for densities below atmospheric. The reason for disagreement at high densities is understood, although a mathematical expression was not obtained. The method used has yielded insight into the reaction mechanism that could not be obtained by curve fitting experimental data. ERA

N77-26256# Avco Corp., Lowell, Mass. Systems Div.
MAGNETIC FLUID DENSITY SEPARATION SYSTEM Final Report, 1 Jul. 1974 - 1 Mar. 1976
Everett P. McQuaid 1 Aug. 1976 129 p refs
(Contract F08606-74-C-0064)
(AD-A035639) Avail: NTIS HC A07/MF A01 CSCL 14/2

A feasibility study was performed on the separation of mixtures of fine powders according to their densities in a gradient magnetic field. Using liquid oxygen and ferrofluids as the separation media, low yield separations of fine particle mixtures at densities up to 4 GM/cc were achieved. A particle interaction force of magnetic origin is considered to be the primary factor influencing the quality of the separations. Additionally the use of ferrofluid as the separation medium alters the apparent density of powders less than about 50 micrometers inversely as their size making an accurate separation by density impossible. Liquid oxygen does not demonstrate this effect and is considered a promising medium for the separation of fine powders. Author (GRA)

N77-26257# Picatinny Arsenal, Dover, N. J.
THE THERMAL DECOMPOSITION OF 2, 3, 4, 6-TETRANITROMETHYL BETA-D-GLUCOPYRANOSIDE
T. Hirata Jan. 1977 37 p refs
(AD-A035584; PA-TM-2223) Avail: NTIS HC A03/MF A01 CSCL 07/2

An initial study of the thermal decomposition of beta-methylglucoside tetranitrate 'beta-megt' has been made. Although a number of experiments were carried out in a static system, the most useful information was obtained from manometric measurements of volume changes during the thermal decomposition. Decomposition was carried out at 120 C, 130 C, 140 C, and 150 C for various time intervals. Thin layer chromatography TLC was used to follow the change in nitrate substituents in the solid residue. There are four trinitrate isomers of beta-methylglucoside however, the TLC analysis only showed three spots at the expected positions for the trinitrates. Rarely was there a clear-out evidence for the fourth trinitrate. As the decomposition proceeded further, the three 'trinitrate' spots also became less intense and other nitrate spots began to appear at lower positions on the TLC strips. Above its melting point, decomposition of beta-megt as followed manometrically, resembled the thermal decomposition of other nitrate esters. GRA

N77-26258# Illinois Univ., Urbana-Champaign. Dept. of Chemistry.
THEORY AND APPLICATIONS OF ELECTRON TRANSFERS AT ELECTRODES AND IN SOLUTION
R. A. Marcus Mar. 1977 23 p refs
(Contract N00014-75-C-0942)
(AD-A037362; TR-6) Avail: NTIS HC A02/MF A01 CSCL 07/4

The theory of simple electron transfers at electrodes and in solution is reviewed, and various thermal fluctuations of coordinates leading to electron transfer are described. A simplified derivation is given of the free energy of such fluctuations. Implications of the theoretical equations for experiment are described. They include relations between rate constants of cross-reactions and self-exchange reactions, between rates of reactions at electrodes and those in solution, nonspecific solvent effects, chemiluminescence, and other properties. Approximate equations of the BEBO type are also given for Tafel slopes, Bronsted slopes and rates of cross-reactions, for systems involving rupture and formation of bonds. GRA

N77-26259# Rockwell International Corp., Canoga Park, Calif. Rocketdyne Div.
INORGANIC HALOGEN OXIDIZER RESEARCH Annual Report, 1 Jan. - 31 Dec. 1976
K. O. Christe, C. J. Schack, and R. D. Wilson 4 Feb. 1977 121 p refs
(Contract N00014-70-C-0294)
(AD-A037421; R-77-112) Avail: NTIS HC A06/MF A01 CSCL 07/2

The novel NF(4+) salts (NF4)2NiF6, (NF4)2TiF6, NF4Ti2F9, NF4Ti3F13, NF4Ti6F25, and NF4SnF5 were synthesized and characterized. The (NF4)2NiF6 and (NF4)2TiF6 salts are of significant interest as ingredients in solid propellant NF3-F2 gas generators for chemical HF-DF lasers. The nickel salt represents the first successful combination of both an energetic perfluoro cation and anion in the form of a stable salt. The theoretical usable fluorine content of this salt is 68 percent higher than that obtainable with KF clinkered NF4BF4, the best previously known system. On thermal decomposition, one cc of solid (NF4)2NiF 6 is capable of producing 1.5 times as much useful fluorine, i.e. in the form of NF3 and F2, as liquid F2 at -187 C. The metathetical NF4BF4 process was refined and high purity (=99%) metathetical NF4BF4 was obtained for the first time, thus eliminating the major drawback of the metathetical route. The process for the synthesis of the NF4SbF6 starting material was also improved by elimination of the cumbersome vacuum pyrolysis step. The usefulness of solid propellant NF3-F2 gas generators for the rapid destruction of magnetic tape was demonstrated. Information was obtained on the intermediates formed in the UV photolytic synthesis of NF4BF4. It was shown by esr spectroscopy that the BF4 radical is formed as the key intermediate during the low-temperature, UV-photolysis of the NF3-F2-BF3 system. The ESCA spectrum of NF4BF4 has been measured. GRA

N77-26260# IIT Research Inst., Chicago, Ill.
DEVELOPMENT OF SMOKE ABATED AIRCRAFT CRASH/RESCUE FIRE FIGHTING TRAINER Final Report, Jun. 1974 - May 1976
Alexander Goldsmith May 1976 130 p refs
(Contract N61339-74-C-0152)
(AD-A035999; IITRI-J6339; NAVTRAEQUIPC-74-C-0152-1)
Avail: NTIS HC A07/MF A01 CSCL 06/7

It was shown previously that liquid petroleum fuels can be burned from a free surface without smoke generation by injecting a water spray near the surface of the burning fuel. This program concerned the extension of this smoke abatement method to aircraft crash/rescue trainers involving fire areas to about 3000 sq ft. Smoke abated fires of realistic severity for training purposes were obtained using either JP-4 or automotive gasoline, while JP-5 and No. 2 diesel oil were found ineffective for this purpose. Field experiments proved the compatibility of smoke-abated JP-4 fires with extinguishment using aqueous film-forming foam. A detailed design is presented for a 50-ft diameter smoke abated fire area for fire-fighting training together with step-by-step procedures for its operation. Author (GRA)

N77-26261# Purdue Univ., Lafayette, Ind. Project SQUID Headquarters.

THE COHERENT FLAME MODEL FOR TURBULENT CHEMICAL REACTIONS Final Report, 1 Mar. 1975 - 31 Jan. 1977

Frank E. Marble and James E. Broadwell (TRW Defense and Space Systems Group, Redondo Beach, Calif.) Jan. 1977 63 p refs

(Contract N00014-75-C-1143; NR Proj. 098-038; Proj. SQUID) (AD-A036768; SQUID-TRW-9-PU) Avail: NTIS HC A04/MF A01 CSCL 21/2

A description of the turbulent diffusion flame is proposed in which the flame structure is composed of a distribution of laminar diffusion flame elements, whose thickness is small in comparison with the large eddies. These elements retain their identity during the flame development; they are strained in their own plane by the gas motion, a process that not only extends their surface area, but also establishes the rate at which a flame element consumes the reactants. Where this flame stretching process has produced a high flame surface density, the flame area per unit volume, adjacent flame elements may consume the intervening reactant, thereby annihilating both flame segments. This is the flame shortening mechanism which, in balance with the flame stretching process, establishes the local level of the flame density. The consumption rate of reactant is then given simply by the product of the local flame density and the reactant consumption rate per unit area of flame surface. The proposed description permits a rather complete separation of the turbulent flow structure, on one hand, and the flame structure, on the other, and in this manner permits the treatment of reactions with complex chemistry with a minimum of added labor. The structure of the strained laminar diffusion flame may be determined by analysis, numerical computation, and by experiment without significant change to the model. GRA

N77-26262# Ballistic Research Labs., Aberdeen Proving Ground, Md.

NEGATIVE IONS IN CO2 Final Report

T. D. Fransler, L. M. Colonna-Romano, and R. N. Varney Feb. 1977 31 p refs

(DA Proj. 1T1-61102-B-53A)

(AD-A037149; BRL-1963) Avail: NTIS HC A03/MF A01 CSCL 20/5

Reaction rate coefficients for negative ions in carbon dioxide have been investigated in a drift tube by analysis of time-of-arrival spectra. Collisional detachment of electrons, clustering of the negative atomic oxygen ion to carbon dioxide, collisional dissociation of the carbon trioxide ion, and electron dissociative attachment have been studied at low pressure and over an order of magnitude range of the ratio of electric field to neutral number density (E/N), starting slightly above thermal. Changes of gas temperature have been shown to act to shift the reaction equilibrium in the same sense that changes in E/N do. Author (GRA)

N77-26263# Arizona Univ., Tucson. Dept. of Physics.

INTRODUCTION TO AND REVIEW OF BEAM-FOIL SPECTROSCOPY

Stanley Bashkin Jan. 1977 93 p refs

(Contract N00014-75-C-0499)

(AD-A036984) Avail: NTIS HC A05/MF A01 CSCL 07/4

This paper divides the subject into four separate parts. In the first, some of the historical developments of beam-foil spectroscopy are reviewed, and examples from various stages in the increasing sophistication of the experiments are given. The second part concentrates on the determination of spectra from different stages of ionization of various elements. The third is concerned with the determination of the lifetimes of excited electronic states. The last part deals with problems which will occupy beamfoil groups in the near future. GRA

N77-26264# North Carolina Univ., Chapel Hill. William R. Kenan Jr. Labs. of Chemistry.

CHEMICAL MODIFICATION OF CARBON ELECTRODES Interim Report

Royce W. Murray Feb. 1977 18 p refs

(Contract N00014-76-T-C-0817)

(AD-A036991; TR-1) Avail: NTIS HC A02/MF A01 CSCL 07/4

Using thermally generated carboxylic acid carbon surface functionalities, tetra(aminophenyl)porphyrin is covalently bound (amide bond) to glassy carbon electrodes. The immobilized porphyrin and its in situ (Co(II)) metallated derivative yield clearly defined, reversible surface electrochemical waves with properties quite similar to those of the conventional solution forms. This is the first example of covalently-immobilized redox systems on carbon electrodes. GRA

N77-26265# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.

THE DEVELOPMENT OF A PARALLEL-CHANNEL SPECTROGRAPHIC DETECTOR: APPLICATIONS TO RAMAN SCATTERING Ph.D. Thesis. Interim Report

Philip Charles Black Mar. 1977 190 p refs

(Contract N00014-76-C-0643)

(AD-A037407; TR-1) Avail: NTIS HC A09/MF A01 CSCL 07/4

A parallel-channel detector was developed for use in visible and near infrared light scattering experiments. The design goal of obtaining quantumlimited response simultaneously over 100 resolvable spectral elements has been achieved. This level of performance allows a significant (100:1) decrease in the time required to obtain a low-light level spectrum, when compared to the acquisition times of conventional detectors, such as the photomultiplier tube or photographic emulsion. Details of the design, construction, and operating characteristics of the parallel-channel detector are given, along with the results of Raman scattering measurements to determine: (1) the vibrational-rotational temperature of a flame; (2) the gas concentration profile of a gas-dynamic system. Implications of these measurement techniques are discussed. GRA

N77-26266# Vermont Univ., Burlington. Dept. of Chemistry.

THE STRUCTURE OF A MIXED-VALENCE IRON FLUORIDE, Fe2F5.2H2O

W. Hall, S. Kim, J. Zubieta, E. G. Walton, and D. B. Brown 9 Feb. 1977 25 p refs Submitted for publication

(Contract N00014-75-C-0756; NR Proj. 356-593)

(AD-A035714; TR-4) Avail: NTIS HC A02/MF A01 CSCL 07/3

The mixed valence iron compound, Fe2, F5.2, H2O, crystallizes in the orthorhombic system, space Imma. The unit cell has dimensions a 7.489 ion sites. The average Fe II-F and Fe III-F bond lengths are 2.060 (6a) and 1.941 (6a), respectively. The aquo groups are coordinated to the iron II with Fe-O bond length of 2.13 (1a). Author (GRA)

N77-26267# Purdue Univ., Lafayette, Ind. Center for Information and Numerical Data Analysis and Synthesis.

THERMOPHYSICAL PROPERTIES OF POLYSTYRENE AND POLY(VINYL CHLORIDE) Final Report

C. Y. Ho, P. D. Desai, K. Y. Wu, T. N. Havill, and T. Y. Lee Mar. 1977 111 p refs

(Contract NBS-C-5-10374)

(PB-265228/7; NBS-GCR-77-83) Avail: NTIS HC A06/MF A01 CSCL 07C

The thermal conductivity, specific heat, density, and thermal diffusivity of polystyrene and poly(vinyl chloride) are evaluated. The compiled data include all the experimental data available from the literature. The recommended values generated from critical evaluation, analysis, and synthesis of the available data and information are for solid (unexpanded) polystyrene with a

density of 1.050 g/cc, for foamed polystyrene expanded with air with densities of 0.060 and 0.010 g/cc, for solid poly(vinyl chloride) with a density of 1.400 g/cc, and for foamed poly(vinyl chloride) expanded with air with densities of 0.060 and 0.020 g/cc. The temperature range covered by the compiled data on some of the properties is from cryogenic temperatures to above the melting point of the material. The recommended values for polystyrene cover the temperature range from 100 to 600 K and those for poly(vinyl chloride) cover the range from 100 to 400 K. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N77-26268 British Library Lending Div., Boston Spa (England).
THE PHASE COMPOSITION OF ALLOYS OF THE SYSTEM Cr-Si-C
M. I. Gasik and P. A. Em [1976] 15 p refs Transl. into ENGLISH from Izv. VUZ Chern. Met. (USSR), v. 8, 1976 p 93-96 In ENGLISH and RUSSIAN
(BLL-M-25504-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

Metallographic and X-ray structural methods were used to study the phase composition of alloys of the system Cr-Si-C. Concentration limits of the phase equilibrium regions were established and a phase composition diagram of the system was constructed. Thirty specimens of alloys were used, obtained in a TVV-2 vacuum furnace by fusion, in alumdum crucibles, of powders of electrolytic chromium (99.8% Cr), semiconductor silicon (99.99% Si), and spectrographically pure graphite. Author

N77-26269*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PLUGGING OF COOLING HOLES IN FILM-COOLED TURBINE VANES
Daniel L. Deadmore and Carl E. Lowell Apr. 1977 23 p refs
(NASA-TM-X-73661; E-9178) Avail: NTIS HC A02/MF A01 CSCL 11F

The plugging of vane cooling holes by impurities in a marine gas turbine was closely simulated in burner rig tests where dopants were added to the combustion products of a clean fuel (Jet-A). Hole plugging occurred when liquid phases, resulting from the dopants, were present in the combustion products. Increasing flame temperature and dopant concentration resulted in an increased rate of deposition and hole plugging. Author

N77-26270*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMOCHEMICAL ANALYSES OF THE OXIDATIVE VAPORIZATION OF METALS AND OXIDES BY OXYGEN MOLECULES AND ATOMS
Fred J. Kohl, Denise M. Leisz, George C. Fryburg, and Carl A. Stearns 1977 25 p refs Presented at Symp. on Corrosion Problems Involving Volatile Corrosion Products, Philadelphia, 8-13 May 1977; sponsored by Electrochem. Soc.
(NASA-TM-X-73682; E-9032) Avail: NTIS HC A02/MF A01 CSCL 11F

Equilibrium thermochemical analyses are employed to describe the vaporization processes of metals and metal oxides upon exposure to molecular and atomic oxygen. Specific analytic results for the chromium-, platinum-, aluminum-, and silicon-oxygen systems are presented. Maximum rates of oxidative vaporization predicted from the thermochemical considerations are compared with experimental results for chromium and platinum. The oxidative vaporization rates of chromium and platinum are considerably enhanced by oxygen atoms. Author

N77-26271*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INFLUENCE OF TEMPER CONDITION ON THE NONLINEAR STRESS-STRAIN BEHAVIOR OF BORON-ALUMINUM Interim Report, Mar. - Oct. 1976
John M. Kennedy (Virginia Polytech. Inst. and State Univ.), Earl T. Herakovich (Virginia Polytech. Inst. and State Univ.), and Darrel R. Tenney Jun. 1977 174 p refs
(Grant NGR-47-004-129)
(NASA-TM-X-74753; VPI-E-77-18; TR-8) Avail: NTIS HC A08/MF A01 CSCL 11F

The influence of temper condition on the tensile and compressive stress-strain behavior for six boron-aluminum laminates was investigated. In addition to monotonic tension and compression tests, tension-tension, compression-compression, and tension--compression tests were conducted to study the effects of cyclic loading. Tensile strength results are a function of the laminate configuration; unidirectional laminates were affected considerably more than other laminates with some strength values increasing and others decreasing. Author

N77-26272*# Kaiser Aluminum and Chemical Corp., Pleasanton, Calif. Center for Technology.
FLAW GROWTH OF 7075, 7475, 7050 AND 7049 ALUMINUM ALLOY PLATE IN STRESS CORROSION ENVIRONMENTS Final Report
R. C. Dorward and K. R. Hasse 15 Oct. 1976 214 p refs
(Contract NAS8-30890)
(NASA-CR-150313; CFT-RR-76-32) Avail: NTIS HC A10/MF A01 CSCL 11F

Marine atmosphere and laboratory stress corrosion test results on smooth and precracked specimens from 7075, 7475, 7050, and 7049 alloy plates (1.25 and 3.0-in. thick) are presented. It is shown that for a given strength level, alloys 7050-T7X and 7049-T7X have superior short-transverse stress corrosion resistance (SCR) to 7X75-T7X. At typical strength levels above the minimum, for example, SCR of these alloys is considerably better than that of 7075-T76, and approaches that of 7075-T73. Alloy 7475 maintains an advantage in the area of fracture toughness, however, because it can be thermally processed to give particularly clean microstructures. Results from precracked specimens are in good qualitative agreement with those obtained from smooth specimens. Although both specimen types are capable of distinguishing between -T6, -T76 and -T73 tempers in relatively short time periods the precracked specimen provides more information about crack growth rates. Author

N77-26273# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
MACHINE CASTING OF FERROUS ALLOYS Interim Report, 1 Jan. - 30 Jun. 1976
M. C. Flemings, K. P. Young, R. G. Riek, J. F. Boylan, and R. L. Bye Nov. 1976 34 p refs
(Contract DAAG46-73-C-0110; ARPA Order-2267)
(AD-A035715; AMMRC-CTR-76-39; IR-5) Avail: NTIS HC A03/MF A01 CSCL 13/8

The basic system for Thixocasting ferrous alloys is fully and reliably operational. The Continuous Rheocaster works dependably in production runs in which typically up to 500 pounds of steel is produced at a rate of about 80 pounds per hour. Much longer runs could be produced if desired. The Thixocast reheating process is completely automated. The two stage heating cycle employed delivers steel charges suitable for Thixocasting with a maximum temperature variation in the charge of + or - 3 C. Work has been primarily on 304 and 440 C stainless steel. Emphasis during this period has been on the production of a large amount of Rheocast stainless steel and the initiation of large scale Thixocasting runs to test actual die life. More than 3,000 pounds of Rheocast stainless steel have been produced to date. Five hundred stainless steel Thixocastings have been produced in a hardened H-13 steel die with die life superior to results reported for H-13 dies used for liquid cast steel. The castings produced showed consistently good internal soundness. This Thixocasting work has been primarily on 304 stainless steel. Additional work is planned on 440 C. Mechanical property evaluation of Thixocast 304 stainless steel indicates it possesses strength superior to the conventionally cast alloy with somewhat less ductility. GRA

N77-26274# Westinghouse Electric Corp., Pittsburgh, Pa.
IRRADIATED DYNAMIC FRACTURE TOUGHNESS OF ASTM A533 GRADE B, CLASS 1 STEEL PLATE AND SUBMERGED ARC WELDMENT
J. A. Davidson, L. J. Ceschini, R. P. Shogan, and G. V. Rao Oct. 1976 93 p refs

(Contracts W-7405-eng-26; NRC-INA-40-551-75; NRC-INA-40-552-75)
(ORNL/SUB-3720-1; WCAP-8775; TR-41) Avail: NTIS HC A05/MF A01

Dynamic fracture toughness tests were conducted on HSST Plate 02 and submerged arc weldment material. Testing performed included 0.394T compact tension, 1.9T compact tension, and 4T compact tension specimens. Data showed that, in the transition region, dynamic test procedures resulted in lower (compared to static) fracture toughness results, and that weak direction (WR) oriented specimen data were lower than the strong direction (RW) oriented specimen results. Irradiated lower bound fracture toughness results of the HSST program material were well above the adjusted ASME Section III K/sub IR/ curve. ERA

N77-26275# Cornell Univ., Ithaca, N.Y.
USE OF STATE VARIABLES IN THE DESCRIPTION OF IRRADIATION CREEP AND DEFORMATION OF METALS
Edward W. Hart and Che-Yu Li 1976 18 p refs Presented at the 3d Intern. Symp. on Zirconium in the Nuclear Industry, Quebec, 10-12 Aug. 1976
(Contract E(11-1)-2172)
(COO-2172-14; Conf-760858-2) Avail: NTIS HC A02/MF A01

Virtually all of the theoretical considerations currently employed are based on micromechanical models for the deformation behavior. The recent theoretical and experimental development of a plastic equation of state for metal deformation has led to the identification of some of the principle micromechanisms in phenomenological terms. The role of the individual mechanisms can be related to the state variables of the description, and those variables are directly accessible measurable quantities. It is shown that the radiation flux and the radiation fluence are expected to affect different components of the equation of state. The resultant description makes considerable use of the information developed in radiation free environments. ERA

N77-26276# Teague (Ben), Austin, Tex.
EFFECT OF TEMPERATURE ON THE MECHANICAL PROPERTIES OF URANIUM
E. M. Savitskii, M. A. Tylkina, and V. F. Terekhova 20 Dec. 1976 22 p refs Transl. into ENGLISH from Tr. Inst. Metall. im. A. A. Baikova, Akad. Nauk SSSR, no. 11, 1962 p 133-142 Sponsored by ERDA Prepared for Sandia Labs., Albuquerque, N. Mex.
(SAND-76-6038) Avail: NTIS HC A02/MF A01

Various mechanical properties of uranium were studied at -196 to 1100 degrees, under low-speed and impact loading. The plasticity and resistance to deformation vary by some orders of magnitude as function of temperature. All the mechanical properties under study, especially under impact loading, indicate that uranium passes through brittle and plastic ranges as it is heated from near absolute zero to the melting point. The brittle and plastic zones in uranium are related to the three polymorphous modifications. It was found that beta uranium (orthohombic) is responsible for the brittleness of uranium, especially under impact loading. The high plastic properties of gamma uranium (bcc) affirm the rule that the high-temperature modifications of polymorphous metals are plastic. The method of mechanical testing is sufficiently reliable for determining the temperatures of the polymorphous transitions in uranium. ERA

N77-26277# Ohio State Univ., Columbus. Dept. of Metallurgical Engineering.
CORROSION, STRESS CORROSION CRACKING, AND ELECTROCHEMISTRY OF THE IRON AND NICKEL BASE ALLOYS IN CAUSTIC ENVIRONMENTS Progress Report, 1 Mar. 1976 - 28 Feb. 1977
A. K. Agrawal 1976 38 p refs
(Contract EY-76-S-02-2421)
(COO-2421-03) Avail: NTIS HC A03/MF A01

Stress corrosion cracking (SCC) of Type 304 stainless steel in 20N caustic solution was investigated in the presence of chromate ions, using the constant strain rate technique. Results confirmed that the chromate ions act as an oxidizing inhibitor and prevent caustic cracking. The threshold concentration of chromate was also confirmed to be 0.005M, in 20N caustic solution. The chromate concentration was also effective in a mixed caustic chloride environment of 20N NaOH + 0.1M NaCl. A fast constraint strain rate technique for predicting the SCC acuity of metals was tested with Type 304 stainless steel in 20N NaOH solution. In order to assess the long term corrosion kinetics of pure nickel in caustic solution, controlled potential coulometry experiments were done in 10N NaOH at 110 C, using several potentials in both the active and the passive regions for over 1,000 minutes each. Periodic analysis showed a nickel concentration always considerably lower than expected from the measured coulometric charge, proving the excellent corrosion resistance of nickel in the caustic environment. ERA

N77-26278# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
EXAMINATION OF A FAILED TRANSITION WELD JOINT AND THE ASSOCIATED BASE METALS
R. J. Gray, J. F. King, J. M. Leitnaker, and G. M. Slaughter Jan. 1977 42 p refs
(Contract W-7405-eng-26)
(ORNL-5223) Avail: NTIS HC A03/MF A01

An examination was made of a failed transition weld joint taken from a coal-fired utility boiler after a service life of 17 years. The failed pipe joint (2.5-in. OD x 0.520-in. wall) consisted of a weld between 2.25 Cr-1 Mo ferritic steel and Type 321 stainless steel with Inconel 132 filler metal. Several diagnostic approaches were followed in the study of this failure. It was not possible to determine the exact mechanism and precise location for failure initiation, but the crack causing failure did initiate and propagate in a narrow band in the heat-affected zone of the ferritic 2.25 Cr-1 Mo steel. A semicontinuous globular phase was found in some areas of this region, and, where prevalent, the crack propagated through it. Several other results are presented along with both qualitative and quantitative information on precipitates extracted from the weld and base metals. Author (ERA)

N77-26279# Los Alamos Scientific Lab., N. Mex.
EXPERIMENTAL STUDIES OF YIELD PHENOMENA IN BIAXIALLY LOADED METALS
Siegfried S. Hecker 1976 33 p refs Presented at the Ann. Meeting of the Am. Soc. of Mech. Engr., New York, 29 Nov. 1976
(Contract W-7405-eng-36)
(LA-UR-76-1413; Conf-761107-1) Avail: NTIS HC A03/MF A01

Biaxial plasticity experiments on metals are summarized to provide a testing ground for models and to serve as a reference guide for materials that may be of practical interest. Most of the work was done on materials assumed to exhibit time-and-pressure-independent plastic flow. Special attention is focused on initial and subsequent yield conditions and stress-strain relations. Some specific examples of material behavior that does not fall within the assumptions of classical plasticity theories are discussed. These include time dependence as evidenced in creep, cyclic loading and strain-rate effects, pressure dependence, large strain behavior, microstructural changes, and failure laws. ERA

N77-26280# Los Alamos Scientific Lab., N. Mex.
MEASUREMENT OF AN EQUATION-OF-STATE POINT FOR MOLYBDENUM AT VERY HIGH PRESSURE
C. E. Ragan, III, M. G. Silbert, and B. C. Diven 1976 12 p refs Presented at the Peaceful Nucl. Explosives meeting, Vienna, 22-26 Nov. 1976
(Contract W-7405-eng-36)
(LA-UR-76-2286; Conf-761127-4) Avail: NTIS HC A02/MF A01

A shock was generated by rapidly fission heating a slab of U-235 by exposing it to neutrons at approximately 1 m from a nuclear explosion and allowing it to expand into an adjacent sample of the material to be studied. A point on the molybdenum equation of state was determined at a pressure of 2.0 TPa (20 Mbar) by measuring directly both the shock velocity and the particle velocity behind the shock. The shock velocity was obtained by measuring the transit time of the planar shock between positions at two depths in the molybdenum. This time interval was determined by observing the light flashes produced when

the shock reached free surfaces located at the two depths. The particle velocity was obtained by observing the Doppler shifts of six neutron resonances in the neutron energy region from 200 to 800 eV in the moving, shocked molybdenum. The pressure and density derived from this pair of velocity measurements, made to an accuracy of +-5 percent, are 20 Mbar. and 25 g/cu cm respectively. ERA

N77-26281# Hanford Engineering Development Lab., Richland, Wash.

EFFECTS OF TEST TEMPERATURE, STRAIN RATE, AND THERMAL EXPOSURE ON THE TENSILE PROPERTIES OF ALLOY 600

J. M. Steichen and A. L. Ward Jul. 1976 32 p refs
(Contract EY-76-C-14-2170)
(HEDL-TME-76-62) Avail: NTIS HC A03/MF A01

The tensile properties of annealed and thermally exposed Alloy 600 were characterized for test and exposure temperatures at 760 C (1400 F) and strain rates to 1.0 sec to the -1 power. Results indicate strength properties and ductility of annealed material are not greatly influenced by strain rate for temperatures to 538 C (1000 F). At the higher temperatures (649 and 760 C) strength properties substantially increase with strain rate. Ductility at these temperatures is controlled by fracture mode (transgranular versus intergranular) and dynamic recrystallization. Thermal exposure at 538 C (1000 F) for durations to 10,000 hours has little effect on tensile properties. Exposure at temperatures of 649 and 760 C (1200 and 1400 F) progressively reduces strength and improves ductility as a result of carbide dissolution and grain growth. ERA

N77-26282# Brookhaven National Lab., Upton, N.Y.

CORRELATION OF HIGH- AND LOW-CYCLE FATIGUE DATA FOR INCOLOY-800H

P. Soo and J. G. Y. Chow Oct. 1976 57 p refs
(Contract EY-76-C-02-0016)
(BNL-NUREG-50574) Avail: NTIS HC A04/MF A01

High-cycle and ultrasonic fatigue data were obtained for Incoloy-800H and an attempt was made to correlate them with available low-cycle data from the literature. Basic differences exist between the three test procedures since the first two involve load control at small amplitudes and high cyclic frequencies, whereas low-cycle testing involves strain control at higher amplitudes and slower strain rates. For tests in the range 70 to 1400 F it is shown that the low- and high-cycle fatigue curves may be correlated as a function of stress if the stable stress levels for the low-cycle experiments are taken to be the effective value. For correlations as a function of strain there is also good agreement between the low- and high-cycle data provided that the effective strains for the latter are obtained from cyclic stress-strain curves. For ultrasonic fatigue the endurance limit at 1100 F is much lower than the value for high cycle testing. ERA

N77-26283# Battelle Columbus Labs., Ohio.

EVALUATING STRENGTH AND DUCTILITY OF IRRADIATED ZIRCALOY. TASK 5 Quarterly Progress Report, Jul. - Sep. 1976

Arthur A. Bauer, Larry M. Lowry, and James S. Perrin Oct. 1976 32 p
(Contract AT(49-24)-0293)
(BMI-NUREG-1961) Avail: NTIS HC A03/MF A01

Tensile tests were performed on unirradiated Zircaloy tubing and the effect of temperature on these properties was investigated. Burst test data were obtained on specimens of irradiated fuel rod cladding at temperatures ranging from 400 to 800 F at a single circumferential strain rate and at 700 F with varying strain rates. Uniform elongation shows no effect of either test temperature or strain rate, while failure strain increases and strength properties tend to decrease as temperature increases and strain rate decreases. Additional transient and isothermal anneals followed by axial tensile tests were performed. The data served to emphasize the strength maximum and ductility minimum, as measured by total elongation, that is observed as recovery of irradiated tubing is initiated, as well as the lag in ductility recovery behind that of strength as annealing proceeds. ERA

N77-26284# Argonne National Lab., Ill. Materials Science Div.

ELEVATED TEMPERATURE CYCLIC DEFORMATION OF STAINLESS-STEEL AND INTERACTION EFFECTS WITH OTHER MODES OF DEFORMATION

A. P. L. Turner 1976 6 p refs Presented at 2nd Intern. Conf. on the Mech. Behavior of Mater., Boston, 16 Aug. 1976; sponsored by Federation of Mater. Soc.
(Contract W-31-109-eng-38)
(CONF-760819-16) Avail: NTIS HC A02/MF A01

Since pertinent information concerning the deformation history of a material is stored in its current structure, an attempt was made to determine the number of state variables necessary to uniquely describe the material's present condition. An experimental program was carried out to determine the number of state variables which is required to describe the tensile test, cyclic, and creep behavior of 304 stainless steel at elevated temperature. Test were conducted at 300 C and 560 C which correspond to homologous temperatures of 1/3 and 1/2, respectively. The experiments consisted of subjecting samples to deformation histories during which the mode of deformation was changed so that two material responses could be measured for the same state of the material. Results strongly suggest that at least two state variables are necessary. Author (ERA)

N77-26285# Ames Lab., Iowa.

LOW TEMPERATURE HEAT CAPACITY OF SCANDIUM AND SCANDIUM ALLOYS

T. W. E. Tsang, K. A. Gschneidner, Jr., and F. A. Schmidt 1976 8 p refs Presented at 12th Rare Earth Res. Conf., Vail, Colo., 18-22 Jul. 1976
(Contract W-7405-eng-82)
(IS-M-72; Conf-760706-6) Avail: NTIS HC A02/MF A01

The heat capacity of several scandium samples containing between 1.6 and 10,000 ppM atomic Fe was measured from 1 to 20 K. Samples containing more than 30 ppM Fe exhibit an anomaly between 1 and 1.5 K, but two scandium samples containing less than 5 ppM Fe did not show any anomalies. ERA

N77-26286# California Univ., Livermore. Lawrence Livermore Lab.

ELECTROLESS-NICKEL PLATING OF A LARGE TURBINE ROTOR FOR THE GEOTHERMAL PROGRAM

Harold J. Wiesner, William J. Comfort, III, William P. Frey, Cecil Gardiner, and Wendell Kelley 1 Sep. 1976 28 p refs
(Contract W-7405-eng-48)
(UCID-17253) Avail: NTIS HC A03/MF A01

The extraction of heat from hot brines in the Salton Sea was discussed. Laboratory studies were conducted with clean, two phase flow, and the necessity of an erosion resistant coating on the blades was recognized. For subsequent laboratory experiments, a large turbine rotor (1.067-m diam) was fabricated from 7075-T6 aluminum. The program for evaluating the effectiveness of various erosion resistant coatings is described. Author ERA

N77-26287# Oak Ridge National Lab., Tenn.

INTERGRANULAR STRESS CORROSION CRACKING OF SENSITIZED CHROME-NICKEL STEELS IN BOILING WATER

G. Herbsleb Sep. 1975 13 p refs Transl. into ENGLISH from VGB Kraftwerkstech. (West Ger.), vol. 55, no. 9, Sep. 1975 p 608-613 Sponsored by ERDA
(ORNL-TR-4272) Avail: NTIS HC A02/MF A01

Potentiostatic controlled experiments were performed under standard atmospheric pressure on round cross section tensile specimens. In boiling solutions the materials were tested under flow heated and sensitized conditions. The degree of sensitizing was determined by the Strauss test method. The specimens were tested in a timed conditioned apparatus and the tests were made in NaCl and Na2SO4 solutions. After the tests, the specimens were inspected metallographically for corrosion attack and its characteristics. Experimental results and conclusions are summarized. B.B.

N77-26288# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Abt. Korrosion.

ELECTROCHEMICAL INVESTIGATION OF GALVANIC CORROSION OF AIRCRAFT MATERIAL COUPLES
Guenter Mierke 12 Nov. 1976 47 p refs In GERMAN; ENGLISH summary
(DLR-FB-76-61) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 20,70

The corrosion current density between base and contact materials was investigated. Aluminum alloys 2024 and 7075 were coupled with titanium alloy Ti6Al4V, heat-treatable steel, stainless steel, and monel metal. For both aluminum alloys, coupling with heat-treatable steel gave the lowest corrosion currents. Low corrosion currents were also measured for the coupling of aluminum alloy 2024 (AlCuMg2) with Ti6Al4V and by the coupling of the alloys 7075 (AlZnMgCu1.5) with monel metal. For all pairs of materials a coating of the contact materials with Celloseel lowered the corrosion current density.
Author (ESA)

N77-26289# Bristol Univ. (England). Dept. of Mechanical Engineering.
CREEP, CYCLIC CREEP, AND FATIGUE FRACTURE IN A LOW ALLOY STEEL Ph.D. Thesis
Malcolm Philip Harper Mar. 1976 235 p refs Sponsored in part by Sci. Res. Council and UKAEA
Avail: NTIS HC A11/MF A01

The possibilities of an accurate prediction of crack propagation rates at elevated temperatures are investigated, taking into account creep and environmental factors. A qualitative model for creep ductility, as applied to the creep crack problem, is proposed. A parameter, C, has recently been suggested as a possible general approach to creep crack propagation. Estimation of C has, however, proved a cumbersome task, and a new method for evaluating C rapidly from test data is developed. Results obtained by applying the new method to existing data are in agreement with previous results. Limitations on the generality of C are discussed and it is concluded that it may be strictly applicable only to cases where constraint is high, and then only to the latter stages of crack growth. Results from the experimental work on a 1 CrMoV steel at 555 C support this hypothesis.
Author (ESA)

N77-26290# Bureau of Mines, Albany, Oreg. Albany Metallurgy Research Center.
VAPOR-PRESSURE MEASUREMENTS BY EFFUSION METHODS Progress Report, Jul. 1966 - Jun. 1970
Arne Landsberg, Arnold Adams, and Stephen D. Hill 1977 33 p refs
(PB-264295/7; BM-RI-8207) Avail: NTIS HC A03/MF A01 CSCL 11F

Vapor pressure measurements were made on FeCl2, FeBr2, FeI2, Sb, Bi, Cd, Mg, Pb, FeCl3, and VCl2 using the Knudsen and torsion effusion methods and on FeCl3-NaCl mixtures, Au2Cl6 and MgNi2 using only the Knudsen method. Apparent vapor pressures calculated from the experimental data vary with orifice size and method of determination. Reaction with residual oxygen in the instruments was noted to have an effect in the iron halide data. Vapor pressure curves plotted as log P vs 1/T for one substance using several orifice sizes tended to converge at a single point when extrapolated beyond the experimental region. All of the data, with the exception of that for VCl2, agree with previously published results. The importance of comparing effusion measurement data with those obtained by other methods and the variations encountered with various orifice sizes are discussed.
GRA

N77-26291# Naval Construction Research Establishment, Dunfermline (Scotland).
EFFECT OF PERCENTAGE BAINITE FORMED AT 400 DEG C ON THE FRACTURE TOUGHNESS PROPERTIES OF AS-QUENCHED HY130
A. J. Caudrey Dec. 1976 35 p refs
(AD-A035948; NCRE/N266) Avail: NTIS HC A03/MF A01 CSCL 11/6

The comparative fracture toughness properties of bainite and martensite in a low alloy high yield strength structural steel have been investigated using the crack opening displacement (COD) technique of general yielding fracture mechanics.
Author (GRA)

N77-26292# Bureau of Mines, Albany, Oreg. Albany Metallurgy Research Center.
CASTING TITANIUM AND ZIRCONIUM IN ZIRCON SAND MOLDS Progress Report
R. K. Koch, J. L. Hoffman, M. L. Transue, and R. A. Beall 1977 51 p refs
(PB-264253/6; BM-RI-8208) Avail: NTIS HC A04/MF A01 CSCL 13H

A zircon sand molding process was developed for static casting small titanium or zirconium shapes. Castings with unfinished weights up to 3.5 kg (7.7 lb) were produced in an inductoslag furnace, and castings up to 7 kg (15.4 lb) were poured in a consumable electrode skull casting furnace. Molds and cores were made by ram modeling foundry-grade zircon sand (AFS gfn 93 to 95) bonded by grade D waterglass and tempered with water. Molds and cores were cured either at 250 C (482F) or 900 C (1652 F). The advantages of low temperature curing are assessed.
GRA

N77-26293# Frankford Arsenal, Philadelphia, Pa.
SPECTROPHOTOMETRIC DETERMINATION OF BORON IN COBALT AND NICKEL COATINGS BY USE OF CARMINIC ACID
George Norwitz and Herman Gordon Jul. 1976 18 p refs
(AD-A037344; FA-TT-76035) Avail: NTIS HC A02/MF A01 CSCL 07/2

A method is proposed for the determination of boron in cobalt and nickel coatings deposited from borane-type baths by electroless techniques. In the method, the deposit is dissolved in hydrochloric acid in the presence of platinum chloride as a catalyst, potassium chloride and mannitol are added, and the solution is evaporated to dryness. Methyl alcohol is then added, the boron is distilled as methyl borate into sodium hydroxide solution, the distillate is evaporated to dryness, and the boron is determined spectrophotometrically using carminic acid. The mannitol prevents loss of boron by volatilization when the solution is evaporated to dryness. The advantage of evaporating the hydrochloric acid solution to dryness is that such treatment eliminates excess acid and water, both of which cause incomplete recovery of boron in the distillation. The potassium chloride, cobalt chloride, and nickel chloride left after the evaporation to dryness dissolve in the hot methyl alcohol during the distillation and do not interfere.
Author (GRA)

N77-26294# Little (Arthur D.), Inc., Cambridge, Mass.
HIGH PRESSURE FURNACE GROWTH OF MERCURY CADMIUM TELLURIDE Final Technical Report, Jun. 1973 - Apr. 1976
John M. Parry Aug. 1976 60 p refs
(Contract F33615-73-C-5155)
(AD-A036918; ADL-C-75953; AFML-TR-76-157) Avail: NTIS HC A04/MF A01 CSCL 17/5

This program involved the preparation of mercury cadmium telluride (HgCdTe) for infrared detectors using high pressure furnace techology. The principal difference between this approach and other techniques is that there is no requirement to seal the ampoule; the mercury vapor present during compounding and recrystallization is contained by the high pressure of inert gas in the furnace coupled with condensation of mercury vapor in the cool neck of the ampoule. The advantage of the method is that, unlike sealed ampoule techniques, the pressure can be varied during preparation and recrystallization and there can be direct access to the melt for temperature measurement. In all thirty ingots were prepared. The manufacturing variables included the rate and technique of solidification, furnace configuration, and times and temperatures during the recrystallization step. Initially difficulties in obtaining large grained crystals of uniform composition were encountered; this was eventually attributed to an inability to control the temperature profile in the high pressure furnace during recrystallization. The technique finally adopted involved compounding and rapid solidification in the high pressure furnace followed by recrystallization of segments of the ingot in sealed quartz ampoules in a conventional furnace with a flat temperature profile.
GRA

N77-26295# Northrop Corp., Hawthorne, Calif. Aircraft Div.
FUNDAMENTAL INVESTIGATION OF FATIGUE CRACK GROWTH RETARDATION IN ALUMINUM ALLOYS Final Technical Report, Jun. 1974 - Jun. 1976
G. R. Chanani Sep. 1976 229 p refs
(Contract F33615-74-C-5126; AF Proj. 7351)
(AD-A037184; NOR-76-110; AFML-TR-76-156) Avail: NTIS HC A11/MF A01 CSCL 11/6

A fundamental investigation was performed to determine the important metallurgical and environmental factors that influence retardation behavior in aluminum alloys. The retardation phenomenon was found to be very complex and dependent on loading variables as well as material parameters. The results suggest that a phenomenological model for prediction of fatigue-crack growth under variable amplitude loading can be developed by taking the various important parameters into account. Of the four alloys investigated (2024-T3, 2024-T8, 7075-T6 and 7075-T73), the alloy with the lowest yield strength, 2024-T3, was found to give maximum delay. The important material parameters were yield strength, cyclic-hardening exponent, and microstructure. Overload ratio (OLR) was the most important test-parameter. An increase in OLR always produced an increased retardation. Crack-arrest occurred at either 2.5 or 3.0 OLR depending on the alloy and the baseline stress-intensity (Kmax). For the 7075-T6 SEN specimens, no significant changes in crack-closure were detected as the cycling progressed after the overload cycle. The overload cycle manifests itself as a stretch band on the fracture surfaces of retardation specimens. The width of the stretch zone increases with increase in Kmax and decrease in thickness. For specimens with discernible striations, correlation between measured da/dN and changes in striation spacing was good. The optical interference technique was found to give a good agreement between measured plastic-zone and that calculated under plane-stress conditions. GRA

N77-26296# George Washington Univ., Washington, D.C. School of Engineering and Applied Science.
A COMPARISON OF THE EFFECTS OF SPECIMEN THICKNESS AND SUBCRITICAL CRACK GROWTH ON SEVERAL NONLINEAR FRACTURE TOUGHNESS PARAMETERS
D. L. Jones, P. K. Poulose, and H. Liebowitz Dec. 1976 37 p refs
(Contract N00014-67-A-0214-0018)
(AD-A037470) Avail: NTIS HC A03/MF A01 CSCL 11/6

Theoretical and experimental comparisons have been made between several nonlinear fracture toughness methods including Jlc (J integral method), GCOD (COD method) and Glc wavy bar (nonlinear energy method). Three series of compact tension specimens of 7075-T651, 2124-T851 and Ti-6Al-4V were tested. Five fracture toughness tests, at thicknesses above and below the minimum value for plane strain fracture, were conducted in each series, and toughness values were compared at: (1) the onset of stable crack growth and (2) at the onset of unstable fracture. It was found that when the critical point was the onset of stable crack growth Jlc, Glc wave bar and Glc bar (linear toughness) were independent of specimen thickness. When the critical point was the onset of unstable fracture all three toughness values increased with decreasing thickness, with Glc wavy bar = Jlc = Glc bar. The GCOD values were much higher than the others in all cases. Author (GRA)

N77-26297# Frankford Arsenal, Philadelphia, Pa.
THE ROLE OF SOLVATED ELECTRONS IN STRESS CORROSION CRACKING PHENOMENA. PART 1: CONCEPTUAL CONSIDERATIONS
Sheldon J. Cytron Oct. 1976 30 p refs
(DA Proj. 1T1-61110-1-A-91)
(AD-A037527; FA-TR-76066-Pt-1) Avail: NTIS HC A03/MF A01 CSCL 20/11

A model is presented in this report that postulates an important role for solvated electrons in stress corrosion cracking phenomena. The cogent feature of this model is the claim that the strain energy released at the crack tip is sufficient to cause the ejection of electrons from the metal. Such electron transfer across the metal/solution interface results in the generation of solvated electrons in the crack tip region. The immediate consequences of this stress induced electron transfer are uninhibited metal dissolution at the crack tip and possible hydrogen atom formation and incorporation into the metal lattice. The validity of this model is yet to be tested. Nevertheless from a conceptual standpoint it offers an intriguing microscopic outlook on what may be occurring during stress corrosion cracking. Several experiments are proposed to test the hypothesis. Author (GRA)

N77-26298# IIT Research Inst., Chicago, Ill.
RESEARCH ON COATINGS OR SURFACE TREATMENT OF METAL POWDERS Final Report, 1 Jun. 1975 - 31 May 1976
Madhav B. Ranade and Anil Goyal Nov. 1976 67 p refs
(Contract F19628-75-C-0186)
(AD-A036870; RADC-TR-76-355) Avail: NTIS HC A04/MF A01 CSCL 07/4

This report describes the research performed under the above contract. The objective of the contract was to assess several techniques utilizing surface treatments or coatings on micron sized metal powders to overcome their agglomerating properties. Under the contract, several techniques including surface treatments, polymer coating and additions of flow agents were investigated. Special efforts including a literature review and experimental adhesion force measurements were directed towards understanding the forces holding the particles. Treatments were evaluated by the measurement of interparticle adhesion forces, tensile strength of powders and release characteristics of the powders in vacuum. A treatment with steam appears to give the best flowing and dispersion characteristics to the powder in air and a .0001 vacuum. The steam treated powder also showed a low tensile strength and a low interparticle force of attraction. Author (GRA)

N77-26299# Southwest Research Inst., San Antonio, Tex.
NONDESTRUCTIVE EVALUATION OF METAL FATIGUE Interim Report, Jan. - Dec. 1976
F. N. Kusenberger, G. A. Matzkannin, P. H. Francis, and J. R. Barton Feb. 1977 43 p refs
(Contract F44620-75-C-0042; AF Proj. 9782; AF Proj. 2307; SwRI Proj. 15-416)
(AD-A037672; SwRI-15-4163; AFOSR-77-1091TR) Avail: NTIS HC A03/MF A01 CSCL 11/6

Magnetic perturbation signatures and Barkhausen noise results have been obtained from an AISI 4340 steel fatigue specimen stress-cycled at 180ksi. The magnetic perturbation signals were obtained over a large number and scan tracks for a variety of applied load conditions and for crack lengths from 0.010 inch to 0.050 inch. The signal amplitude varies with load and crack length in agreement with analytical results for magnetic leakage fields, whereas the signal shape appears to be related to the crack depth and localized plastic zones. Analysis of the magnetic perturbation data suggests a crack opening model for small surface entering fatigue cracks in which the crack opens in response to applied external forces as though the adjacent crack surfaces are hinged at the bottom. Analytical work is in progress to interpret these results in terms of the magneto-mechanical properties in the vicinity of the fatigue crack. Barkhausen noise signals were obtained on a grid pattern in the vicinity of several fatigue cracks with a Barkhausen detection probe 1/5 the length of the cracks. The results can be interpreted in terms of the stress fields in the vicinity of the cracks. AF 1410 steel fatigue specimens are being fabricated for magnetic perturbation and Barkhausen noise analysis measurements. Fatigue cracks in Ti-6Al-4V specimens were investigated with the electric current injection technique. GRA

N77-26300# Aluminum Co. of America, Alcoa Center, Pa. Alcoa Labs.
EFFECTS OF MICROSTRUCTURE ON FATIGUE CRACK GROWTH OF HIGH-STRENGTH ALUMINUM ALLOYS Final Technical Report, May 1974 - May 1976
W. G. Truckner, J. T. Staley, R. J. Bucci, and A. B. Thakker Aug. 1976 277 p refs
(Contract F33615-74-C-5079; AF Proj. 7351)
(AD-A037156; AFML-TR-76-169; Rept-56-76-AF5) Avail: NTIS HC A13/MF A01 CSCL 11/6

Effects of microstructure and composition on resistance to fatigue crack growth were determined using constant amplitude loading conditions in low and high humidity air at test frequencies

of 2 and 20 Hz. Strengthening precipitate had the largest effect at delta K above about 4 KSI sq. root of (in.), while solute composition had the largest effect at delta K below about 3 KSI sq. root of (in.). Large intermetallic particles affected growth at high and intermediate levels of delta K. Author (GRA)

N77-26301# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Energy Systems Div.

MICROSTRUCTURE AND MECHANICAL PROPERTIES OF PRODUCT FROM EXTRUSION-CONSOLIDATED 7075 Al PREALLOYED POWDER Interim Report, 16 Dec. 1973 - 1 Jul. 1976

D. J. Abson, F. J. Gurney, and V. DePierre Wright-Patterson AFB, Ohio AFML Nov. 1976 42 p refs
(Contract F33615-74-C-5059)
(AD-A037188; AFML-TR-76-194) Avail: NTIS HC A03/MF A01 CSCL 11/6

Microstructural changes occurring during the extrusion-consolidation of prealloyed 7075 stock were investigated and compared with those occurring in the wrought stock (from which the powder was produced) processed in the same manner as the powder. Emphasis is placed on two areas: (1) The effects of processing variables (starting material condition, processing temperature and amount of deformation) on the microstructure of the processed material. (2) Correlation of the product microstructures with product room tensile properties after a final standard T6 heat treatment. The microstructure of the extrusion-consolidation powder product differed in several respects from that of the wrought stock product extruded by the same processing conditions. The latter had a uniform microstructure while the former contained a marked inhomogeneity of both the distribution of the precipitate and the size of the substructure or grain structure (from one powder particle to another) and the presence of oxide boundaries on deformed powder particles. The differences are attributed to the following characteristics of the starting materials: (1) The powder consisted of chilled cast particles coated with oxide films and containing elements (such as chromium) in various degrees of super-saturated solution in different particles. (2) The wrought material was homogeneous without any apparent oxide films. GRA

N77-26302# Army Construction Engineering Research Lab., Champaign, Ill.

EFFECT OF LACK OF PENETRATION ON FATIGUE RESISTANCE OF HIGH-STRENGTH STRUCTURAL STEEL WELDS Final Report

Y. Tobe, E. P. Cox, and F. V. Lawrence, Jr. Feb. 1977 31 p refs
(AD-A037047; CERL-TR-M-203) Avail: NTIS HC A03/MF A01 CSCL 11/6

Zero-to-tension fatigue tests were carried out on double-V butt welds of ASTM A514 steel plate, 20 mm in thickness, which contained full-length lack of penetration (LOP) defects. The fatigue crack initiation and propagation portions of the specimens' fatigue lives were experimentally separated. Compression-to-tension fatigue tests were carried out on prime base plate, as-welded sound joints, and reinforcement-removed welds to experimentally determine the fatigue strength reduction factor (Kf) of the LOP defects. LOP defects as small as 0.5 mm wide had a profound effect on fatigue life. The fatigue crack initiation life was found to be short - only 10 percent of the total life - and could be predicted using fatigue crack initiation concepts. The use of KF(max), the maximum possible fatigue strength reduction factor, was found to be appropriate. In a separate substudy, the fatigue resistance of ASTM A514 butt-welded joints containing clustered porosity was determined. Author (GRA)

N77-26303# Rock Island Arsenal, Ill. General Thomas J. Rodman Lab.

THE EFFECTS OF SINTERING PARAMETERS AND PARTICLE SIZE DISTRIBUTION ON P/M STEEL FORGINGS

Andrew Crowson and Ferrel E. Anderson 22 Dec. 1976 44 p refs
(AD-A036983; RIA-R-TR-76-048) Avail: NTIS HC A03/MF A01 CSCL 11/6

The effects of sintering parameters and particle size distributions on the properties of steel P/M forgings were investigated. Sintering parameters studied were hydrogen flow rate, methane flow rate, and sintering time and temperature. Various unimodal and bimodal particle size distributions designed from statistically determined powder blends were investigated in the powder distribution study. Oxygen content and final density in the forgings strongly depend on the proper selection of the sintering parameters. Among the sintering parameters studied, hydrogen flow rate and temperature predominately influence the final P/M steel forging properties. The tensile and yield strengths of the P/M forgings were not sensitive to particle size distribution differences. Ductility and impact properties, however, improve with small particle size distributions. The increase in the ductility and impact properties correlates with lower oxide content, which in turn, is attributed to the decrease in oxide inclusions present in the powder particles. Author (GRA)

N77-26304# TRW, Inc., Cleveland, Ohio. Equipment Materials Technology.

INHIBITION OF HYDROGEN EMBRITTLEMENT IN HIGH STRENGTH STEEL

C. S. Kortovich Feb. 1977 53 p refs
(Contract N00014-74-C-0365)
(AD-A037355; TRW-ER-7814-2) Avail: NTIS HC A04/MF A01 CSCL 11/6

The addition of rare earth gettering agents to trap hydrogen was evaluated as a method of reducing the embrittlement problems in steel cathodically charged with hydrogen. Additions of lanthanum and cerium made to AISI 4340 steel were used in the 0.03-0.17 weight percent range. Mechanical property results were comparable for both elements and indicated that while some degradation in property levels occurred, particularly at the high rare earth content, most of the aircraft quality specification minimums for 4340 high strength steel were attained. An important exception was the Charpy impact strength, which was approximately 15% below the minimum. Property loss was attributed to the formation of continuous rare earth oxide inclusions at prior austenite grain boundaries. Delayed failure test results indicated substantial improvements in hydrogen embrittlement resistance for high rare earth content (=0.15 weight percent) steels. This was manifested in terms of increased time to crack initiation (incubation time), increased failure time, higher values for the lower critical stress intensity and lower crack growth rates compared to baseline 4340 or the low rare earth modifications. Cerium was slightly superior to lanthanum only in terms of resulting in a higher level for the lower critical stress intensity. Author (GRA)

N77-26305# American Univ., Washington, D.C. Dept. of Chemistry.

COMPLEX FORMATION IN METAL DISSOLUTION AND METAL TREATMENT Technical Progress Report

R. T. Foley Mar. 1977 27 p refs
(Contract N00014-75-C-0799; NR Proj. 036-106)
(AD-A037404; TR-6) Avail: NTIS HC A03/MF A01 CSCL 11/6

This report examines the concept that a critical step in metal dissolution or metal reaction involves the formation of metal-anion complexes and further, the nature of the complex dictates the ensuing reaction, be it accelerated dissolution or protective film formation. This is the concept which furnishes the basis for the 'complex ion theory' of corrosion. Various lines of evidence are cited to support the theory, including the existence of a stoichiometric order of reaction for the pitting of iron, stainless steel, and aluminum alloys in halide solutions, the spectrophotometric observation of iron-anion complexes during the dissolution of iron in acid solutions and the decay of the scrape potential in various electrolytic solutions. New supporting data are presented using relaxation theory treatment of scrape potential and scrape current measurements. Reactions at the interface between oxide-free metal and aqueous solutions take place during time durations similar to those reported for the formation of complexes in solution, also, studied with relaxation techniques. GRA

N77-26306# Arcos Corp., Philadelphia, Pa.

DEVELOPMENT OF ALL-POSITION COATED WELDING ELECTRODE OF CHROMIUM-ENRICHED CUPRONICKEL ALLOY Final Report

Clyde V. Prestowitz 31 Jan. 1977 35 p

(Contract N00014-74-C-0139)
(AD-A037150) Avail: NTIS HC A03/MF A01 CSCL 11/5

A three-phase program for the development of a satisfactory all-position chromium-enriched cupronickel electrode was proposed by Arcos Corporation and accepted by the government. In Phase I experimental electrodes were produced and screened for welding operation by use of horizontal and vertical fillets. The electrodes deemed most promising in the operational tests were then checked initially for weld metal soundness via test 8a, the vertical plate of specification MIL-E-22200/4B and Arcos modified test 8a, a simulated pipe test. In Phase II, the best electrodes from Phase I testing were evaluated for conformance to tentative mechanical properties and weld metal composition, and weld metal soundness in the flat position by use of test 3 of specification MIL-E-22200/4B. In Phase III, pipe welds were made in 4 in. NPS class 700 chromium-enriched cupronickel pipe with electrodes culled by use of Phase I and II tests. The procedure used was test 9 of specificiation MIL-E-22200/4A interim amendment 3. A total of (50) formulas were made and evaluated. A successful electrode with excellent operational characteristics was developed, and a demonstration was made before an NSRD representative. Recommendations for further work were presented. Author (GRA)

N77-26307# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
RESEARCH STUDY IN GROWTH OF ALUMINUM-NITRIDE ON SAPPHIRE PIEZOELECTRIC FILMS Final Report, 1 Dec. 1974 - 31 Jul. 1976
Kenneth M. Lakin and James K. Liu Aug. 1976 78 p refs
(Contract F19628-75-C-0098)
(AD-A037793; RADC-TR-76-361) Avail: NTIS HC A05/MF A01 CSCL 20/2

The growth and characterization of aluminum nitride epitaxial films on R-plane sapphire have been investigated in an eighteen month program aimed at improving the quality and uniformity of the material for use in microwave bandpass filters. This report details the entire process of AIN film processing starting from the polishing of sapphire wafers and ending with the electrical characterization of the resultant films. The polishing of sapphire proved to be a major effort because the constraints of wafer thickness optical flatness, wafer bowing due to thermal expansion stresses, and a defect free surface finish were not all compatible. Improvements were made in the AIN growth system and operating procedure which resulted in films of lower defect density, lower apparent strain, and improved acoustoelectric characteristics. Etching of the polished AIN surface followed by SEM examination was implemented as a means of checking crystal film perfection. Measurements made on the temperature coefficient of delay of the film composite have shown values as low as 13 ppm for a thickness to wavelength ratio of 0.66 and indicate that zero temperature coefficient will be obtained at a somewhat larger thickness. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N77-26308*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
BORON TRIFLUORIDE COATINGS FOR THERMOPLASTIC MATERIALS Patent Application
Ronald M. Kubacki, Inventor (to NASA) (Bell and Howell, Chicago) Filed 17 Jun. 1977 10 p Sponsored by NASA
(NASA-Case-ARC-11057-1; US-Patent-Appl-SN-807762) Avail: NTIS HC A02/MF A01 CSCL 11G

Plastic surfaces can be inproved physically and optically by treating them with a plasma of boron trifluoride. The trifluoride can be the sole reactant or be part of a mixture also containing an organic monomeric substance such as perfluorobutene-2 or an organosilane. The boron trifluoride-containing coating can also serve as an intermediate coating between the plastic surface and a plasma deposited organic polymer. NASA

N77-26309# Naval Research Lab., Washington, D. C.
BREAK-UP DYNAMICS OF POLYMER BEADS UNDER LASER BOMBARDMENT Interim Report
J. R. Greig and R. E. Pechacek Feb. 1977 17 p Presented at the Annual Meeting of the Div. of Plasma Phys. 17th, St. Petersburg, Fla. 10-14 Nov. 1975
(AD-A037718; NRL-MR-3448) Avail: NTIS HC A02/MF A01 CSCL 20/5

Spherical polymer beads approximately 1 mm diameter, have been irradiated with a 100 J, 40 nsec Q-switched Nd/glass laser. This is not enough energy to dissociate and ionize all the atoms contained in the polymer bead. Instead a small fraction (about 1%) of the material is ablated from the irradiated side of the bead accounting for about 60% of the laser pulse energy. The remainder of the polymer bead subsequently disintegrates in a symmetric, reproducible manner. Approximately 15% of the laser pulse energy is used in this disintegration to dissociate about 30% of the molecules in the polymer bead. The balance of the laser pulse energy (about 25%) is lost in reflection at glass surfaces and at the target itself. If the laser pulse is preceded by a prepulse containing about 15% of the total pulse energy, the gas released by molecular dissociation is mostly released within 1 microsecond of the peak laser power. Also the disintegration and gas release are both approximately spherically symmetric about the initial target point. However with no prepulse approximately the same amount of gas is released over a longer time period, and this gas and the debris of the target are ejected away from the laser. Author (GRA)

N77-26310# Dow Corning Corp., Midland, Mich. Dept. of Rubber Systems Research.
MATERIAL STUDIES FOR PROTECTIVE MASKS Final Report, 26 Dec. 1968 - 30 Jul. 1975
R. G. Chaffee Sep. 1976 227 p refs
(Contract DAAA15-69-C-0291)
(AD-A036736; ED-CR-76040) Avail: NTIS HC A11/MF A01 CSCL 06/17

The objective of this program was to conduct a study of available commercial and experimental elastomers that possessed the optical and physical characteristics desired for fabrication of an improved design protective mask. If such an elastomer was not available a test program was to be conducted to develop a suitable elastomer. A survey of available elastomers was conducted without successfully finding one that combined all the desired qualities. A development program to modify certain 'organic' elastomer formulations to obtain better clarity had only marginal success. A research program was also initiated to produce a clear silicone elastomer that also possessed the needed physical properties, impermeability, surface characteristics, low temperature flexibility and molding cycle characteristics. Each of these needed characteristics were solved singularly - not all were met in a single elastomer formulation. The elastomer that possessed the best optical clarity, physical property profile, and low-temperature flexibility coupled with potential production capability gave marginal, in accordance with the desired specifications, resistance to permeation. It also was not resistant to surface indentation or dirt pickup. A flexible silicone resin overcoat greatly reduced the soiling tendency. Considerable surface and coatings studies, which included an adhesion study, were undertaken. Candidate films and coatings have been identified and development effort will continue. Author (GRA)

N77-26311# Ceramic Finishing Co., State College, Pa.
LOCALIZED DAMAGE IN A VISCOUS MEDIUM GLASS. APPENDIX A. VARIATIONS IN LOCALIZED IMPACT DAMAGE CAUSED BY NOMINALLY SIMILAR IMPACTS. APPENDIX B. CRACK BRANCHING AT HERTZ CRACKS Technical Report, Jun. 1976 - Jan. 1977
Henry P. Kirchner and Robert M. Gruver Jan. 1977 72 p refs
(Contract N00014-74-C-0241)
(AD-A037303; TR-5) Avail: NTIS HC A04/MF A01 CSCL 20/11

Glass plates were lightly abraded and impacted by glass spheres at various velocities and temperatures. The incoming and rebounding velocities were measured by high speed photography. The coefficients of restitution, kinetic energies and kinetic energy losses were calculated. At room temperatures the

coefficient of restitution decreases with increasing velocity. The kinetic energy losses appear to increase linearly with increasing kinetic energy at low velocities but at higher velocities the losses increase at a faster rate. This greater increase may result from additional loss mechanisms associated with fracturing of the surface. At temperatures above 580 C viscous flow permits indentation of the surface. The losses associated with the viscous flow reduce the coefficient of restitution over the entire velocity range. The impact damage was characterized by optical and scanning electron microscopy. Typically, the ring cracks show extensive crack branching which is clearly revealed in etched specimens. The crack branching was used to locate the fracture origin of the Hertz cracks and to estimate the fracture stresses. These fracture stresses were compared with estimates based on the Hertz theory. Forty specimens were subjected to similar impacts at a velocity near the threshold for Hertz crack formation. Hertz cracks were observed in approximately half of these specimens. The penetration of these cracks varied over a wide range. GRA

N77-26312# Oak Ridge National Lab., Tenn.
LAP SHEAR STRENGTH OF SELECTED ADHESIVES (EPOXY, VARNISH, B-STAGE GLASS CLOTH) IN LIQUID NITROGEN AND AT ROOM TEMPERATURE
K. J. Froelich and C. M. Fitzpatrick Dec. 1976 21 p
(ORNL/TM-5658) Avail: NTIS HC A02/MF A01

The adhesives included several epoxy resins, a varnish, and a B stage glass cloth (a partially cured resin in a fiberglass cloth matrix). Several parameters critical to bond strength were varied: adhesive and adherend differences, surface preparation, coupling agents, glass cloth, epoxy thickness, fillers, and bonding pressure and temperature. The highest lap shear strengths were obtained with the B shear glass cloth at both liquid nitrogen and room temperatures with values of approximately 20 MPa (3,000 psi) and approximately 25.5 MPa (3,700 psi) respectively. ERA

N77-26313# Princeton Univ., N. J. Plasma Physics Lab.
LAMINATED BEAMS: DEFLECTION AND STRESS AS A FUNCTION OF EPOXY SHEAR MODULUS
J. Bialek 1976 48 p refs Presented at the Conf. on Structural Analysis Needs for Magnetic Fusion Energy Super Conducting Magnets, Upton, N.Y., 8-10 Sep. 1976
(Contract E(11-1)-3073)
(PPPL-1287; Conf-760984-1) Avail: NTIS HC A03/MF A01

The large toroidal field coil deflections observed during the PLT power test are due to the poor shear behavior of the insulation material used between layers of copper. An analysis of laminated beams that explicitly models the mechanical behavior of each layer in a laminated beam and hence avoids the pitfalls involved in any averaging technique is presented. In particular, the shear modulus of the epoxy in a laminated beam (consisting of alternate layers of metal and epoxy) may span the entire range of values from zero to classical. Solution of the governing differential equations defines the stress, strain, and deflection for any point within a laminated beam. These governing equations are summarized, and a parametric study of a simple laminated beam is also included. ERA

N77-26314# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
HIGH TEMPERATURE PROPERTIES AND PROCESSES IN CERAMICS: THERMOMIGRATION Annual Report, 1 Apr. - 31 Dec. 1976
1976 26 p refs
(Contract E(11-1)-2923)
(COO-2923-001) Avail: NTIS HC A03/MF A01

Research progress is summarized in the following areas: thermal gradients and defects in FeO, thermomigration in Fe-Al spinels, application of an ion microprobe to analysis of concentration gradients in ceramics, and anion self-diffusion in aluminum oxide. ERA

N77-26315# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Section Plastiques.
OPTIMIZATION OF THE CHARACTERISTICS OF STRUCTURAL REINFORCED PLASTICS. PART I: GENERAL THEORY [OPTIMISATION DES CHARACTERISTIQUES DES PLASTIQUES ARMES STRUCTURAUX. PREMIERE PARTIE: THEORIE GENERALE]
Jacques Rondali (Liege Univ.) Jan. 1977 74 p refs In FRENCH; ENGLISH summary Sponsored by the Inst. pour l'Encour. de la Rech. Sci. dans l'Ind. et l'Agr.
(CRIF-PL-10) Avail: NTIS HC A04/MF A01

Methods for optimizing standard design in reinforced plastics are discussed. The methods are considered essential in view of economics obtainable in material usage. The number of calculations to be carried out necessitates the use of computers. The background of optimization computer programs is described. ESA

N77-26316# California Univ., Los Angeles. School of Engineering and Applied Science.
SYNTHESIS OF NEW SUPERHARD MATERIALS AND THEIR APPLICATION TO CUTTING TOOLS Semiannual Technical Report, 1 Apr. - 30 Sep. 1976
R. F. Bunshah and A. H. Shabaik Nov. 1976 33 p refs
(Contract F44620-74-C-0044; ARPA Order 2574)
(AD-A035579; AFOSR-77-0057TR; SATR-5) Avail: NTIS HC A03/MF A01 CSCL 13/9

The process of Activated Reactive Evaporation ARE is used to synthesize superhard materials like carbides, oxides, nitrides and ultrafine grain cermets. The deposits are characterized by hardness, microstructure, microprobe analyses for chemistry and lattice parameter measurements. The synthesis and characterization of TiC-Co cermets is given. Machining evaluation of coated high speed tool steel inserts of types M-42 high speed steel (1/2in. X 1/2in. X 1/8in.) were prepared from bar stock and heat treated to a hardness of RC 64 prior to hard coating by the ARE process. Screening tests using a fixed set of machining conditions were carried out. The coating variables studied were surface preparation prior to coating, composition of the coating TiC and TiC-10 NI and biasing of the substrate i.e., 0 volts or ARE process and -2000 volts or biased ARE process. In all cases, the cutting forces were markedly lower for the hard coated tools as compared to the uncoated tools. Examination of the coated samples in the scanning electron microscope revealed that the coated tools showed much less wear than the uncoated tools. Some experiments were also tried with TiC coatings on cemented carbide WC-Co tool inserts. Again, the coated inserts showed much less wear so it is to be concluded that the effect is that consistent hard coatings of the type investigated do exhibit improved machinability. GRA

N77-26317# Utah Univ., Salt Lake City. Dept. of Chemical Engineering.
CONFORMATIONAL ANALYSIS OF POLYMERS Final Report, 18 Oct. 1971 - 31 Dec. 1976
Richard H. Boyd 18 Feb. 1977 8 p refs
(Contract DAAG29-72-C-0002)
(AD-A037092; ARO-10259.11-C) Avail: NTIS HC A02/MF A01 CSCL 07/4

The project dealt with applying conformational energy calculations to polymers. The early stages involved using energy parameters developed for small or ordinary sized hydrocarbon molecules to calculate the stable conformations and barriers to rotation in isolated hydrocarbon polymer molecules. Later stages involved simulating localized molecular motions postulated to be the basis for relaxations or transitions that control mechanical properties of bulk plastics. Calculational methods were developed that permit, in favorable circumstances, the inclusion of the response of the surrounding chains to localized motions of a chain in the bulk phase. Finally, a new set of energy parameters (or force-field) was developed for phosphazenes so that the conformational energy method can be applied to polyphosphazenes. It should now be possible to study the properties of phosphazene polymers by this method. Author (GRA)

N77-26318# California Univ., Berkeley. Dept. of Chemical Engineering.
PROPERTIES AND STRUCTURE OF POLYMERIC ALLOYS
Mitchel Shen and Hiromichi Kawai (Kyoto Univ., Japan) 1 Feb. 1977 100 p refs
(Contract N00014-75-C-0955)
(AD-A037240; TR-11) Avail: NTIS HC A05/MF A01 CSCL 07/3

Because of the generally immiscible nature of polymers, multicomponent polymers or polymeric alloys often exhibit microphase separation. The morphologies of these heterogeneous materials are determined not only by the composition of the system but also by the processing conditions. The resulting microstructures exert a profound influence on the properties of the polymeric alloys. The purpose of this review is to discuss the more recent advances in the investigation of the relation between the structure of the polymeric alloys and their properties. An understanding of this relationship would be important in being able to 'tailor make' better materials and exploit the unique properties of these materials for engineering applications.
Author (GRA)

N77-26319# Army Materials and Mechanics Research Center, Watertown, Mass.
PROCEEDINGS OF THE TTCP-3 CRITICAL REVIEW: TECHNIQUES FOR THE CHARACTERIZATION OF POLYMERIC MATERIALS Final Report
Jan. 1977 369 p refs Proc. Held at Watertown, Mass., 6-8 Jul. 1976
(AD-A036082; AMMRC-MS-77-2) Avail: NTIS HC A16/MF A01 CSCL 11/9

The objective of this review is to evaluate the potential of new and/or improved techniques and combinations thereof in the prediction of field life of polymeric and composite materials in military hardware. Author (GRA)

N77-26320# Navy Clothing and Textile Research Unit, Natick, Mass.
NON-REFLECTIVE, WETTABLE, FIBROUS FABRIC ASSEMBLIES FOR FIREFIGHTERS' CLOTHING
Zelig Kupferman Jan. 1977 34 p refs
(AD-A038028; TR-123; Rept-6-76) Avail: NTIS HC A03/MF A01 CSCL 06/17

The Navy Clothing and Textile Research Facility (NCTRF) has developed a nonreflective, wettable, firefighters' proximity garment made from water-absorptive fibrous fabric assemblies in combination with a vapor barrier fabric and insulation liner. When wetted out, the garment affords heat protection equal to or greater than the highly reflective, aluminized material currently being used in garments worn by firefighters in close proximity JP-4 fuel fires. Laboratory investigation of comparative heat-protective characteristics of fibrous fabric assemblies shows that, when they are dry and exposed to a radiant heat flux of 1.82 cal/sq cm/sec from about 50 to 83 seconds (total heat transfer of 150 F to back of assembly), the outershell, inner liner and vapor barrier are charred while the insulation liner exhibits no change. Seven of the dry assemblies, when tested wet for a minimum exposure time of 180 seconds, showed the surface of the outershell exhibited no change to burnt, the surface of the inner liner exhibited no change to singed, and the vapor barrier and insulation liner no change. After mild abrasion and soiling, the aluminized 20-ounce asbestos fabrics, in assembly with a vapor barrier and insulation liner and exposed to the same test conditions as the wet assemblies, showed a significant reduction in exposure time of 48 seconds, compared with the wet fabric assembly and slightly worse than the dry fabric assemblies. GRA

N77-26321# Washington State Univ., Pullman. Dept. of Materials Science and Engineering.
ELECTROINITIATED POLYMERIZATION OF MONOMERS ON METAL ELECTRODES Final Report, 1 Jan. 1974 - 31 Dec. 1976
B. K. Garg, R. A. V. Raff, and R. V. Subramanian 15 Feb. 1977 50 p refs
(Grant DAAG29-74-G-0078)
(AD-A036989; FR-1) Avail: NTIS HC A03/MF A01 CSCL 11/3

The use of electropolymerization to coat metal electrode surfaces with polymers formed in situ was investigated in detail. Electrolysis was carried out in a three compartment cell with fritted disc separators such that polymerization occurred in the middle compartment only. Both anodic and cathodic reactions were utilized to form coating on pretreated metal surfaces. It was shown that polymerization occurred both by vinyl polymerization of olefin monomers as well as ring opening reactions of cyclic monomers. The factors that control the coating thickness, the morphology of the polymer deposit and the adhesion of the polymer formed to the metal substrates were determined. It was found that the growth of the coating on electrode followed the chain polymerization kinetics to a considerable degree. However, increased current did not necessarily lead to increased coating thickness because it also led to increased early termination of growing polymer chains to form soluble low molecular weight products. Water, because of its high surface tension, encourages physical adsorption on metal surfaces of organic monomers dissolved in it. Thus, water was found to be unique as solvent for obtaining coatings with good adhesion to metal substrates. Several types of bonding, other than bond formation caused by polymerization reactions, were identified. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N77-26322*# Kanner (Leo) Associates, Redwood City, Calif.
EFFECT OF NAPHTHOLS ON THE THERMAL STABILITY OF FUELS
L. Z. Oblasova, G. D. Kharlampovich, and A. I. Stekhun Washington NASA Jun. 1977 5 p Transl. into ENGLISH from Neftepererabotka i Neftekhim. (Moscow), no. 1, 1973 p 3-4
(Contract NASw-2790)
(NASA-TT-F-17302) Avail: NTIS HC A02/MF A01 CSCL 21D

Monosubstituted alkylnaphthols in the form of alpha- and beta-isopropyl- and -isobutylnaphthols are shown to have high antioxidant properties, form homogenous phases with fuels, and be soluble in fuels. The inhibition activity of the compounds approach that of the antioxidant additive Topanol A. The thermal stability of hydrorefined aviation fuel T-7 (boiling range 140-240 deg, S content 0.002%) treated with the naphthol additives is tested in contact with Cu plates. Author

N77-26323# Sandia Labs., Albuquerque, N. Mex. Explosive Projects Div.
CALCULATION OF PERFORMANCE PARAMETERS OF AN ELECTROEXPLOSIVE DEVICE USING DIGITAL DATA TECHNIQUES
Arnold C. Strasburg Dec. 1976 45 p ref
(Contract E(29-1)-789)
(SAND-76-0373) Avail: NTIS HC A03/MF A01

Procedures were developed to calculate performance parameters from input and output responses generated by an electroexplosive device subjected to a functional test. The data system assembly consists largely of commercially available hardware. The basic concepts can be implemented in varying degrees of sophistication with other types and models of equipment. The system and programs, including predecessor programs, were used successfully for two years. Operating experience to-date indicates that a data system of this type is a most versatile tool for use in an explosive component testing facility. ERA

N77-26324# Battelle Columbus Labs., Ohio.
SYSTEMS STUDY OF FUELS FROM SUGARCANE, SWEET SORGHUM, SUGAR BEETS, AND CORN Quarterly Report for period ending 15 Jun. 1976
E. S. Lipinsky, T. A. McClure, W. J. Sheppard, J. L. Otis, W. T. Lawhon, and R. A. Nathan 30 Jun. 1976 95 p refs
(Contract W-7405-eng-92)
(TID-27336; QR-4) Avail: NTIS HC A05/MF A01

Preliminary results are presented of an economic analysis of the agricultural and conversion aspects of producing fuel and ammonia from sugar beets, sweet sorghum, and corn. Ethanol would be produced by fermentation of cane juice and methanol and ammonia from the synthesis of gas obtained from the partial oxidation of the combustible organics using the Purox process. ERA

N77-26325# Arizona State Univ., Tempe. College of Engineering and Applied Sciences.

CONVERSION OF WASTE ORGANIC MATERIAL TO GASOLINE

James L. Kuester 1976 7 p refs Presented at the 4th national conference on Energy and the Environment, Cincinnati, Oct. 1976

(Contract E(11-1)-2982; N60530-76-C-0121; Grant NSF SMI-76-02988)

(COO-2982-7; Conf-761016-6) Avail: NTIS HC A02/MF A01

The method is based on the Fischer-Tropsch synthesis of straight-chain hydrocarbons from the pyrolysis gas with the subsequent reforming of these hydrocarbons to gasoline. The concept appears technically feasible. Implementation on a large scale is dependent on refinements in process performance and demonstrated operational reliability. If these objectives are achieved, the process economics could be attractive. ERA

N77-26326# Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).

LITERATURE SURVEY ON TOXICOLOGIC IMPLICATIONS OF MANIPULATING SOME SOLID ROCKET PROPELLANTS [LITERATUURONDERZOEK INZAKE DE TOXICOLOGISCHE IMPLICATIES VAN HET HANTEREN VAN ENIGE VASTE RAKETBRANDSTOFFEN]

D. M. W. Elskamp Nov. 1976 11 p In DUTCH

(Contract A76/KL/063)

(MBL-1976-12; TDCK-68561) Avail: NTIS HC A02/MF A01

Composition, preventive measures, therapy, and medical test requirements of the solid rocket propellants 2.75 inch Rocket Engine Mk.4, AIM-9B Rocket Engine Mk.17, Nike Rocket Engine M30, Nike Rocket Engine M98, and Hawk Rocket Engine M22 are presented. ESA

N77-26327# Institut Franco-Allemand de Recherches, St. Louis (France).

DETERMINATION OF NEGATIVE ION MASS SPECTRA OF SOME EXPLOSIVES [BESTIMMUNG DER MASSENSPEKTREN NEGATIVER IONEN EINIGER EXPLOSIVSTOFFE]

F. Daeublin 1 Aug. 1975 56 p refs In GEORGIAN

(ISL-R-126/75) Avail: NTIS HC A04/MF A01

The reactions of ortho-, para-, di-, and trinitrotoluene vapors to electron bombardment were investigated with a mass spectrometer. Possible relations with the reaction zone for detonation were also examined. The negative ion mass spectra were found to be simple (few lines) and similar for the low mass range. The most frequent fragment is NO2 - (massnumber 46). Negative ions occur frequently for certain low electron collision energies between 1 and 3 eV. ESA

N77-26328# Institut Franco-Allemand de Recherches, St. Louis (France).

COMPARISON BETWEEN TWO GAS DYNAMIC COMPUTATION MODELS OF INTERIOR BALLISTICS [VERGLEICH ZWEIER GASDYNAMISCHER RECHENMODELLE DER INNENBALLISTIK]

K. Hoog and G. Krauth 8 Nov. 1976 20 p In GEORGIAN Presented at Symp. on Innenballistische Leistungssteigerung von Rohrwaffen, Swisttal-Heimerzheim, West Ger., 25-27 Oct. 1976

(ISL-CO-219/76) Avail: NTIS HC A02/MF A01

Two gas dynamic models for calculations in interior ballistics are presented and compared. One model, in Lagrange coordinates, is based on the method of characteristics and designated as a single phase model. The other, in Euler coordinates, is based on a difference method, and designated as a two phase model.ESA

N77-26329# Institut Franco-Allemand de Recherches, St. Louis (France).

POWDER GAS TEMPERATURE VARIATION IN THE BARREL OF AN EXPERIMENTAL CANNON. FIRST MEASUREMENTS [VERLAUF DER PULVERGASTEMPERATUR IM LAUF EINES GASDRUCKMESSERS. ERSTE MESSUNGEN]

H. Mach, H. Masur, and U. Werner 16 Mar. 1976 50 p refs In GEORGIAN

(ISL-R-109/76) Avail: NTIS HC A03/MF A01

A method is described for temperature measurement of the propellant gas in the barrel of a 20 mm cannon during launching of the projectile. The temperature distribution within the barrel is measured by detecting the spectral emission of the powder gas flow through six windows along the barrel. Results of initial measurements are presented. ESA

N77-26330# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.

ENGINE PERFORMANCE AND FIRE-SAFETY CHARACTERISTICS OF WATER-CONTAINING DIESEL FUELS Interim Report, Jun. - Aug. 1976

Edwin C. Owens and Bernard R. Wright Dec. 1976 27 p refs

(Contracts DAAK02-75-C-0082; DAAG53-76-C-0003)

(AD-A036011; AFLRL-83) Avail: NTIS HC A03/MF A01 CSCL 21/4

Recent flammability evaluations conducted at U.S. Army Fuels and Lubricants Research Laboratory AFLRL have shown that water-containing diesel fuels are more fire resistant 'even at temperatures above the flash point' than the same fuel without the water added. These findings led to this project to evaluate the compatibility of such fuels with a full scale diesel engine. Blends of base diesel fuel plus 2-percent emulsifying agent plus as much as 10-percent water were evaluated in an unmodified LDT-465-1 C, a multifuel diesel engine with wide field usage. No significant changes were observed in power output when operating the engine at equal base fuel flow rates. The smoke-reduction effects were inconclusive, but the nonvisible emissions were substantially altered. Oxides of nitrogen emissions were decreased as much as 30 percent but were accompanied by a 250-percent increase in unburned hydrocarbons. The conclusion followed that potential fire-safety benefits and a lack of major detrimental effects in the engine make these water/fuel blends attractive candidates for fire-resistant combat fuels.

Author (GRA)

N77-26331# Martin Marietta Aerospace, Denver, Colo.

USAF PROPELLANT HANDBOOKS. NITRIC ACID/NITROGEN TETROXIDE OXIDIZERS, VOLUME 2 Final Report, Mar. - Dec. 1976

Alfred C. Wright Feb. 1977 207 p refs

(Contract F04611-76-C-0026; AF Proj. 3058)

(AD-A036741; AFRPL-TR-76-76) Avail: NTIS HC A10/MF A01 CSCL 21/9

The Nitric Acid/Nitrogen Tetroxide Oxidizer Handbook is a compilation of engineering information on the physical and chemical properties, storage and handling, production, transportation, safety, and material compatibility of the nitric acid/nitrogen tetroxide family of oxidizers and their blends. It contains information on the following propellants: Nitric Acid (IRFNA), High Density Acid, Nitrogen Tetroxide, MON-1, MON-3, MON-10, MON-25, Minuteman Grade N2O4. The propellant handbook is intended to be used for R and D personnel and test engineers who are directly involved in the utilization of liquid rocket propellants and the design of liquid rocket propulsion systems and facilities. Author (GRA)

N77-26332# Space Sciences, Inc., Monrovia, Calif.

A MASS SPECTROMETER INVESTIGATION OF THE CHEMISTRY OF PLATEAU BURNING PROPELLANTS

Milton Farber and R. D. Srivastava Nov. 1976 56 p refs

(Contract N00014-75-C-0986)

(AD-A035602; SSI-TR-1) Avail: NTIS HC A04/MF A01 CSCL 21/9

A mass spectrometer study has been conducted involving double base plateau burning propellants containing lead and copper organic salts. The pyrolysis and combustion of the metallic salts were also investigated. The results revealed that the metallic salts decompose to the gaseous and condensed phase metallic elements. The gaseous lead or copper atoms then react with the nitrate esters to form compounds such as Pb NO2 and Cu NO2, which are stable in the intermediate temperature zones. When the nitrites enter the combustion zone they react to produce the metallic hydroxides and oxides as predicted by the thermodynamic equilibria. GRA

N77-26333# Naval Air Propulsion Test Center, Trenton, N.J. Propulsion Technology and Project Engineering Dept.

ANALYSIS AND TESTING OF JP-5 FUEL DERIVED FROM COAL Final Report

C. J. Nowack Jan. 1977 60 p

(AD-A036073; NAPTC-PE-99) Avail: NTIS HC A04/MF A01 CSCL 21/4

Syncrudes derived from Utah and Western Kentucky coals by the COED process were refined into 10 gallon quantities of a JP-5 type aviation fuel. The kerosene cuts from the two syncrudes were hydrotreated in two stages. A single stage treatment provided a high aromatic (20-25 percent volume) fuel and the two stages a low aromatic (0-5 percent) fuel. The properties of the four synfuels were evaluated for their conformance to the MIL-T-5624K specification requirements for grade JP-5. Material compatibility and storage/thermal oxidation stability studies were also conducted. Approximately 250 gallons of a high aromatic fuel were also refined from a Western Kentucky coal syncrude. Performance and exhaust emission tests were performed on a T63 engine using this fuel. The compatibility of the fuel with filtration equipment (coalescers) was also studied. Author (GRA)

N77-26334# Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain).

GASIFICATION AND IGNITION OF A CONDENSED FUEL BY A HOT STAGNANT GAS Final Report, Apr. 1973 - Apr. 1976

M. Kindelan and A. Linan 1977 15 p refs

(Contract F61052-69-C-0036; Grant AF-AFOSR-2535-73; AF Proj. 9711)

(AD-A037976; AFOSR-77-0314TR) Avail: NTIS HC A02/MF A01 CSCL 21/2

Asymptotic techniques based on the limit of high activation energy have been used to analyze the ignition process of a condensed fuel suddenly exposed to a hot stagnant gas. Several cases are studied differing in the location of the exothermic ignition reaction. In a first part, an analysis is presented of the gasification process when an equilibrium process or a rate process is considered to determine the gasification rate, and the use of these results to study ignition by a fast exothermic gas-phase reaction. In a second part an analysis is presented of ignition by a heterogeneous exothermic reaction including the convective effects of the gasification flow. In a third part an analysis is presented of ignition by a condensed phase reaction and the derivation of a closed form expression for the ignition time. In a fourth part an analysis is presented of the heterogeneous ignition process by convective heating described by a Newtonian law. Details of these analyses are given in previous scientific reports. Author (GRA)

N77-26335# Union Carbide Corp., Tarrytown, N.Y. Chemicals and Plastics Div.

FLUORODINITRO SILICON COMPOUNDS. PART 1: ORGANOSILICON AND SILICATE ESTERS OF 2,2,2-FLUORODINITROETHANOL PART 2: NONHYDROLYZABLE SILANES Final Report, 1 Apr. 1975 - 30 Jun. 1977

Robert S. Neale and Thomas C. Williams 28 Feb. 1977 76 p refs

(Contract N00014-75-C-0791)

(AD-A037464) Avail: NTIS HC A05/MF A01 CSCL 19/1

Silanes esters of 2,2,2-fluorodinitroethanol (ROH) have been prepared from chlorosilanes in approx. 90% yields. The noncompressive shock sensitivity of the high density (1.95 g/cc), crystalline orthoester (RO)4 Si was clearly lower than that of RDX, but the calculated detonation velocities proved similar. Substantially higher boiling points at similar densities (approx. 1.6 g/cc) relative to the reference compound FEFO were realized in the liquid esters (RO)3SiCH3 and (RO)2(CH3)SiOSi(CH3)(OR)2. The sensitivity of the thermally stable product esters toward hydrolysis by atmospheric moisture varied greatly. The energy contents Q of a number of silicon-containing structures were calculated. GRA

N77-26336# Picatinny Arsenal, Dover, N. J.

EXPLOSIVE TESTS FOR ESTABLISHING HAZARD CLASSIFICATION FOR M1 SP PROPELLANT IN AUTOMATED SINGLE-BASE FINISHING OPERATIONS Final Report

C. H. Johnson and Richard Rindner Jan. 1977 38 p Original contains color illustrations

(AD-A037383; PA-TR-5020) Avail: NTIS HC A03/MF A01 CSCL 19/1

Adequacy of a prototype propellant storage hopper was established for venting burning reaction gases to preclude an explosive reaction in the air-dry operation of the automated single-base line (ASBL). Four hundred and fifty pounds of M1SP propellant (for 105 mm ammunition) did not transit from burning to an explosion when bottom flame initiated in a specially designed hopper incorporating pressure-relief venting. Implementation of this hopper design will reduce an assessed Class 7 explosive hazard to a Class 2 burning hazard in ASBL finishing operations. The ratio of propellant surface to hopper vent area was determined which will permit venting of burning gases and, in turn, preclude an explosive reaction in manufacturing and storage vessels. Also the susceptibility of M1SP propellant to transit from burning to an explosion was established in steel confinement in test diameters up to 18 inches. Author (GRA)

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N77-26337# Oxford Univ. (England). Dept. of Engineering Science.

ANALYSIS OF NITROGEN AND AIR LIQUEFACTION SYSTEMS

K. G. Narayankhedhar 1976 74 p refs

(OUEL-1163/76) Avail: NTIS HC A04/MF A01

The existing liquefaction systems were analyzed over a wide range of operating conditions to arrive at the optimum operating conditions for each of the systems. Results are presented in the nondimensional parameters, namely, figure of merit and fraction of the total flow of gas which is liquefied. A low pressure turbine cycle (turbine operating between atmospheric and sub-atmosphere pressures) is suggested which obviates the necessity of an oil-free compressor. A detailed analysis of this cycle leading to the optimum operating conditions is also presented. Author (ESA)

N77-26338# Naval Ship Research and Development Center, Bethesda, Md. Ship Performance Dept.

EXPERIMENTAL INVESTIGATION OF HYDRODYNAMIC COEFFICIENTS OF A SMALL-WATERPLANE AREA, TWIN-HULL MODEL

Choung M. Lee and Lawrence O. Murray Jan. 1977 91 p refs

(SF43421202)

(AD-A035908; SPD-747-01) Avail: NTIS HC A05/MF A01 CSCL 13/10

Experiments were conducted on a small waterplane area, twin-hull SWATH model designated as SWATH 6 A to determine the hydrodynamic coefficients associated with the following fin-body combinations: bare hull with forward fin, bare hull with aft fin, and bare hull with forward and aft fins. Three types of experiments were conducted at several speeds: calm-water towing for various fixed drafts and trim angles, forced oscillation in both the pitch and heave modes, and towing in regular head waves. The objective of the investigation was to verify the computational methods used for predicting the motions of a SWATH ship in waves. In general, agreement between measured and computed hydrodynamic coefficients, confirmed the validity of the computational method used. The study also proved valuable insight for improving both the methods of computing the hydrodynamic coefficients and the method of measuring the forces and moments of SWATH models. GRA

N77-26339# Office of Naval Research, London (England).

OBSERVATIONS ON EUROPEAN LOW-TEMPERATURE PHYSICS RESEARCH: AN ANNOTATED DIRECTORY OF LOW-TEMPERATURE PHYSICS IN BRITISH UNIVERSITIES AND SOME COMMENTS ON THE LOW TEMPERATURE PHYSICS PROGRAMS IN EUROPE

Thomas A. Kitchens 28 Dec. 1976 20 p

(AD-A036959; ONRL-R-13-76) Avail: NTIS HC A02/MF A01 CSCL 20/12

This report summarizes the author's observations on low-temperature physics research in Europe during the period of August 1975-August 1976. It features an annotated directory of low temperature research in British Universities, and contains comments on visits to Continental institutions, both of which supplement ONRL Report D-15:1973 'Directory of European Low Temperature Research' by E. Edelsack et al. Emphasis in the comments is on refrigeration and low temperature components rather than on superconductivity. Author (GRA)

N77-26340# National Bureau of Standards, Boulder, Colo. Inst. for Basic Standards.
THE NATIONAL MEASUREMENT SYSTEM FOR SURFACE PROPERTIES Final Report
C. J. Powell Dec. 1976 80 p refs
(PB-264258/5; NBSIR-75-945) Avail: NTIS HC A05/MF A01 CSCL 20L

Emphasis is placed on the properties needed to characterize a solid surface, particularly surface composition, surface atomic structure and surface electronic structure; these characteristics directly affect many important surface properties or processes that occur on surfaces. The above three forms of surface characterization are widely used in surface-science experiments while measurements of surface composition are routinely made to solve a wide variety of problems in the semiconductor, chemical, petroleum and metallurgical industries for applications ranging from process and device development, process control, process evaluation to failure analysis. GRA

N77-26341# IIT Research Inst., Chicago, Ill.
NSF/RANN 4TH GRANTEES' CONFERENCE ON PRODUCTION RESEARCH AND TECHNOLOGY
1976 167 p refs Conf. proc. held at Chicago, 30 Nov. - 2 Dec. 1976
(Grant NSF APR-75-09589)
(PB-265817/7; NSF/RA-770015) Avail: NTIS HC A08/MF A01 CSCL 13H

The conference was a forum for the presentation and discussion of work done in a particular group of National Science Foundation (NSF) sponsored projects, and closely related industrial projects. The conference's focus was advanced research and development in automation and production technologies, with special reference to the discrete goods industries. It brought together grantees of NSF to present recent research results in manufacturing technology research, as well as a select group of managers, scientists, and engineers most responsible for applying research results to the increase of productivity of American industry. Papers included in this volume cover topics such as computer-aided injection molding systems, complex materials handling and assembly systems, tool wear sensors, computer assisted design, computer assisted manufacture, and robot computations for orienting workpieces. Abstracts of all papers are provided. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N77-26342 British Library Lending Div., Boston Spa (England).
IMPROVEMENT OF THE PICTURE DEFINITION OF A TELEVISION SIGNAL OF LIMITED FREQUENCY BANDWIDTH BY LINEAR MEASURES
H. Schroder Apr. 1977 12 p refs Transl. into ENGLISH from Siemens Forsch.-und Entwicklungsberichte (Berlin), V. 5, no. 2, 1976 p 57-60
(BLL-RTS-10578) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

The problem of forming the transmission channel so that the picture definition of a received picture is the best possible is discussed. An introduction is given to the physical processes, which are responsible for the picture definition in the transmission and reception of such television signals. Theoretically determined frequency curves are compared and analyzed. Author

N77-26343 British Library Lending Div., Boston Spa (England).
MEASUREMENT OF LONG-TERM PHASE JITTER IN STUFFING MULTIPLEX SYSTEMS FOR PCM AND DATA SIGNALS
B. Mueller 28 Oct. 1976 14 p refs Transl. into ENGLISH from Nachrtech. z. UTZ (Frankfurt am Main), v. 24, no. 29, 1976 p 307-313
(BLL-PO-Trans-3407-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.

Phase jitter with low frequency components is studied. Examples of an experiment are discussed at what amount low frequency phase jitter accumulates in chains of multiplexer-demultiplexer pairs. By using a tape recorder capable of FM recording in a measuring equipment the accumulation phase jitter can be stored. Experimental data of density, variance, distribution function of the phase jitter amplitude are given. Results show sufficient long sequences of accumulating jitter and values can be concluded from time averaged values. Author

N77-26344 British Library Lending Div., Boston Spa (England).
THE EFFECTS OF PERIODIC CABLE DEFECTS UPON THE TRANSMISSION OF WIDEBAND SIGNALS
K. Erdel Nov. 1976 23 p refs Transl. into ENGLISH from Siemens Res. and Develop. Report (Heidelberg), v. 5, no. 4, 1976 p 187-193
(BLL-Trans-3433-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.

The transmission of analog wideband signals via coaxial cables of fluctuations which can be caused by imperfections in the manufactures of the cables are studied. Various line modes were used for a mathematical description of a line with periodic imperfections. A transfer function P(f) for the reflected voltage is obtained by adding the voltage surges which are reflected to the starting point of the line by the individual reflection sites. Author

N77-26345 British Library Lending Div., Boston Spa (England).
THE ELECTRET MICROPHONE: A NEW MICROPHONE FOR TELEPHONY
Jan-Olof Hedman 14 Oct. 1976 9 p Transl. into ENGLISH from Tele (Sweden), no. 4, 1975 p 8-10
(BLL-PO-3384-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.

Methods of operation and a description of the electret microphone are given. Construction and methods of production are presented, as well as experimental results and conclusions. B.B.

N77-26346 British Library Lending Div., Boston Spa (England).
THE PRINCIPLES OF DIMENSIONING LINED CIRCULAR WAVEGUIDES
Hans-Georg Unger 28 Oct. 1976 37 p refs Transl. into ENGLISH from Archiv der Elek. Uebertragung (West Ger.), v. 18, no. 3, Mar. 1964 p 141-152
(BLL-PO-3394-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.

A circular waveguide with a wall lining for H/sub 01 transmission may be replaced by a waveguide with anisotropic impedance walls for the purposes of calculation. The latter's wall resistances can be easily determined even for a wall lining consisting of many anisotropic layers. Simple approximations are valid for the H/sub 01 attenuation and H/sub 01 phase constants provided that the wall lining has an electrical thickness of less than lambda/12. For the propagation of interference modes, one of two different approximations applies in each case, and that for all practical wall linings. Author

N77-26347*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Electrical Engineering.
A DEPOLARIZATION AND ATTENUATION EXPERIMENT USING THE CTS SATELLITE Quarterly Technical Progress Report, 1 Oct. - 31 Dec. 1976
C. W. Bostian, S. B. Holt, Jr., S. R. Kauffman, E. A. Manus, R. E. Marshall, W. L. Stutzman, and P. H. Wiley 28 Feb. 1977 36 p

(Contract NAS5-22577)
(NASA-CR-152535; QTPR-1) Avail: NTIS HC A03/MF A01 CSCL 17B

Rain attenuation and depolarization data collected on the communications technology satellite 11.7 GHz downlink, and changes made in equipment following rain leak damage to the parametric amplifier are discussed. A 15 GHz radar system is described. Author

N77-26348*# LinCom Corp., Pasadena, Calif.
HARDWARE SIMULATION OF KU-BAND SPACECRAFT RECEIVER AND BIT SYNCHRONIZER, PHASE 2, VOLUME 1
W. C. Lindsey and Barry R. Eisenberg Mar. 1977 172 p
(Contract NAS9-14636)
(NASA-CR-151439; TR-03-75-06-5) Avail: NTIS HC A08/MF A01 CSCL 17B

The acquisition behavior of the PN subsystem of an automatically acquiring spacecraft receiver was studied. A symbol synchronizer subsystem was constructed and integrated into the composite simulation of the receiver. The overall performance of the receiver when subjected to anomalies such as signal fades was evaluated. Potential problems associated with PN/carrier sweep interactions were investigated. Author

N77-26349*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MONTE CARLO ANALYSIS OF UNCERTAINTY PROPAGATION IN A STRATOSPHERIC MODEL. 2: UNCERTAINTIES DUE TO REACTION RATES
R. S. Stolarski, D. M. Butler, and R. D. Rundel (NASA Johnson Space Center) May 1977 21 p refs
(NASA-TM-X-71339; X-624-77-123) Avail: NTIS HC A02/MF A01 CSCL 20N

A concise stratospheric model was used in a Monte-Carlo analysis of the propagation of reaction rate uncertainties through the calculation of an ozone perturbation due to the addition of chlorine. Two thousand Monte-Carlo cases were run with 55 reaction rates being varied. Excellent convergence was obtained in the output distributions because the model is sensitive to the uncertainties in only about 10 reactions. For a 1 ppby chlorine perturbation added to a 1.5 ppby chlorine background, the resultant 1 sigma uncertainty on the ozone perturbation is a factor of 1.69 on the high side and 1.80 on the low side. The corresponding 2 sigma factors are 2.86 and 3.23. Results are also given for the uncertainties, due to reaction rates, in the ambient concentrations of stratospheric species. Author

N77-26350# Network Analysis Corp., Glen Cove, N. Y.
LOCAL, REGIONAL AND LARGE SCALE INTEGRATED NETWORKS: VOLUME 1. LARGE NETWORKS FOR DEFENSE COMMUNICATIONS: STRATEGIES, PERFORMANCE MEASURES AND COST TRENDS
Howard Frank, Israel Gitman, and Richard VanSlyke Feb. 1976 94 p
(Contract DAHC15-73-C-0135; ARPA Order 2286)
(AD-A035949; SATR-6) Avail: NTIS HC A05/MF A01 CSCL 17/2

Investigations into local, regional, and large scale packet switched network cost and performance for Defense Department communications are summarized. The issues examined include: (1) alternative large network architectures; (2) performance evaluation criteria; (3) formulation of the large network design problem; (4) defense communication requirements; (5) local access network tradeoffs; (6) backbone and total network performance and cost characteristics; and (7) applications to AUTODIN II. Author

N77-26351# Network Analysis Corp., Glen Cove, N. Y.
LOCAL, REGIONAL AND LARGE SCALE INTEGRATED NETWORKS. VOLUME 2. RECENT ADVANCES IN GROUND PACKET RADIO SYSTEMS
Howard Frank, Israel Gitman, and Richard VanSlyke Feb. 1976 184 p
(Contract DAHC15-73-C-0135; ARPA Order 2286)
(AD-A035950; SATR-6) Avail: NTIS HC A09/MF A01 CSCL 17/2

This technical report presents significant accomplishments in the development of computational techniques for network analysis and design, and the following cost/performance tradeoffs for data and computer communication networks cost-effectiveness and economies of scale previously demonstrated for medium size packet switching networks (e.g., ARPANET) extend to large scale networks, (e.g., 10 Mbs throughput). The most cost-effective architecture for large scale networks is a multi-level hierachical structure. The cost of hierarchical networks is not very sensitive to number or backbone nodes near the optimum. The local access cost is approximately 50% of the total, and is the most sensitive component. For autodin II, Phase I, the minimum cost backbone network configuration is a hybrid terrestrial-satellite net with six out of eight nodes, ground stations, resulting in 25% savings in backbone line cost compared to a terrestrial net only. Author (GRA)

N77-26352# Network Analysis Corp., Glen Cove, N. Y.
LOCAL, REGIONAL AND LARGE SCALE INTEGRATED NETWORKS. VOLUME 3. RECENT ADVANCES IN LARGE SCALE INTEGRATED NETWORKS
Howard Frank, Israel Gitman, and Richard Vanslyke Feb. 1976 306 p refs
(Contract DAHC15-73-C-0135; ARPA Order 2286)
(AD-A035951; SATR-6) Avail: NTIS HC A14/MF A01 CSCL 17/2

The large network research conducted by Network Analysis Corporation under contract with the Advanced Research Projects Agency had the following objectives: To define delay and reliability performance criteria for large network design. To identify adequate network structures for large, distributed requirements. To investigate the impact of system parameters and characteristics (e.g., hardware cost, line cost, traffic volume etc.) on large network design and performance. To determine the impact of satellite carriers on large network design. To determine the impact of precedence and priority procedures on network design and performance in a large network environment, with a wide variety of traffic types and delay requirements. An integrated, multilevel network architecture was shown to be the most cost-effective solution for large, distributed requirements. The multilevel architecture offers the best trade-off between line costs, switch costs and delay and reliability performance. Furthermore, it shows excellent controllability and growth flexibility properties. GRA

N77-26353# Network Analysis Corp., Glen Cove, N. Y.
LOCAL, REGIONAL AND LARGE SCALE INTEGRATED NETWORKS; VOLUME 4. LOCAL AND REGIONAL COMMUNICATION NETWORKS - TECHNOLOGIES AND ARCHITECTURES
Howard Frank Feb. 1976 176 p
(Contract DAHC15-73-C-0135; ARPA Order 2286)
(AD-A035952) Avail: NTIS HC A09/MF A01 CSCL 17/2

Contents: Multidrop and Loop Alternatives for Terminal Access to a Backbone Network- A Case Study, a Local Distribution Network using the Packet Radio Technology- a Case Study, An Urban Alternative, Experiments on Packet Data Transmission over Cable Video Systems, Comparison of Alternative Technologies for Local Distribution. GRA

N77-26354# Network Analysis Corp., Glen Cove, N. Y.
LOCAL, REGIONAL AND LARGE SCALE
Howard Frank, Israel Gitman, and Richard VanSlyke Feb. 1976 132 p refs
(Contract DAHC15-73-C-0135)
(AD-A03593) Avail: NTIS HC A07/MF A01 CSCL 17/2

Contents: System for Automatic Remote Job Entry Backtracking Algorithms for Network Reliability Analysis Exact Algorithms for Network Reliability Analysis. GRA

N77-26355# Rome Air Development Center, Griffiss AFB, N.Y.
EFFECT OF CW-396A RADOME ON THE RADIATION PATTERN OF RECTANGULAR ANTENNAS
Ronald L. Fante, Peter R. Franchi, and Richard L. Taylor Dec. 1976 34 p
(AD-A036960; RADC-TR-76-397) Avail: NTIS HC A03/MF A01 CSCL 17/9

This report studies the effect of the CW-396A radome on the radiation pattern of a number of different rectangular antennas. It was found that this radome produces grating lobes, which

are approximately 30 dB below the main beam level at L-band and approximately 23 dB lower at S-band. A FORTRAN listing of the computer program used is included in this report. GRA

N77-26356# Rome Air Development Center, Griffiss AFB, N.Y.
EFFECT OF MULTIPATH ON THE HEIGHT-FINDING CAPABILITIES OF A FIXED-REFLECTOR RADAR SYSTEM. PART 3: EFFECT OF RADOME
Ronald L. Fante Dec. 1976 18 p refs
(AD-A037957; RADC-TR-76-379-Pt-3) Avail: NTIS HC A02/MF A01 CSCL 17/9

It has been demonstrated that the ribs of the CW-396A radome have a negligible effect on the L -band elevation plane radiation pattern and consequently on the altitude error curves for the air-search radar discussed in Part 2 of this report (RADC-TR-215). In particular, the radome produces grating lobes that are approximately 30 dB below the main beam level.
Author (GRA)

N77-26357# Naval Undersea Center, San Diego, Calif.
PRINCIPLES AND APPLICATIONS OF ADAPTIVE FILTERS: A TUTORIAL REVIEW
John M. McCool Mar. 1977 39 p refs
(AD-A037755; NUC-TP-530) Avail: NTIS HC A03/MF A01 CSCL 09/4

This report reviews the characteristics of a class of adaptive filters useful in signal processing and other applications where the properties of the signal are unknown or variable with time. The basic element of these filters is the adaptive linear combiner, which weights (adjusts the gain of) and sums a set of input signals to form a single output signal. The weighting process is governed by a recursive algorithm that seeks to minimize the mean square of the difference between the combiner's output and a 'desired response' (training signal). It is shown that for statistically stationary inputs the mean-square difference is a quadratic function of the weight values, allowing the minimum to be sought by gradient estimation and other similar techniques. Expressions are given that define the relationship between rate of adaptation and deviation from optimal performance due to noise in the gradient estimation process for the Widrow-Hoff LMS algorithm. Methods of deriving the inputs to the combiner are described, including the use of a tapped delay line to form an adaptive transversal filter. Experimental results obtained by computer simulation are presented that show the ability of the adaptive transversal filter to model an unknown network or physical system; to reduce or eliminate intersymbol interference in multipath communication channels; to reduce or eliminate periodic interference in electrocardiography and broadband interference in the sidelobes of an antenna array; and to separate periodic and broadband signals and detect very low level periodic signals. Author (GRA)

N77-26358# Valvo G.m.b.H., Hamburg (West Germany).
DEVELOPMENT OF A KLYSTRON FOR SATELLITE OPERATION IN THE 12 GHz FREQUENCY BAND Final Report
Enzio Demmel, Heinz Bohlen, Uwe Feddern, and Klaus Liepelt Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1976 77 p In GERMAN; ENGLISH summary
(Contract BMFT-WRT-2073/01A0023)
(BMFT-FB-W-76-24) Avail: NTIS HC A05/MF A01; ZLDI, Munich DM 16,20

The development of a 12 GHz klystron for operation in TV-broadcasting satellites with an RF output power of 800 W is described. The development makes use of technological and operational experience gained with a klystron presently in operation in terrestrial 12 GHz TV transmitters with amplitude modulation. A klystron was realized with a lightweight PPM focusing system. It operated uncritically over a wide range of voltage and power. Using a 3-stage depressed collector the efficiency could be increased to more than 50%. The bandwidth of 30 MHz as required for a FM TV transmission and the linearity performance (AM-PM conversion, AM-PM transfer and cross modulation) were obtained. The variations of group delay time are given by the characteristic of a 4-stage bandpass filter with a bandwidth of 30 MHz. The investigated concept of a PPM-focused klystron is seen as the basis for the design of a spaceborne klystron with a direct radiating collector, an efficiency of more than 50%, and a total mass of approximately 1.5 kg. Author (ESA)

N77-26359# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
SPEECH UNDERSTANDING SYSTEMS. VOLUME 1: INTRODUCTION AND OVERVIEW Final Report, 30 Oct. 1974 - 29 Oct. 1976
William A. Woods, Madeleine Bates, Geoffrey Brown, Bertram C. Bruce, Craig C. Cook, Laura Gould, Gregory Harris, Dennis H. Klatt, John W. Klovstad, John I. Makhoul et al Dec. 1976 89 p refs 5 Vol.
(Contract N00014-75-C-0533)
(AD-A035165; BBN-3438-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 17/2

This five-volume report reviews the BBN speech understanding system. The speech understanding project attempts to develop a continuous speech understanding system which uses syntactic, semantic, and pragmatic support from higher level linguistic knowledge sources to compensate for the inherent acoustic indeterminacies in continuous spoken utterances. These knowledge sources are integrated with sophisticated signal processing and acoustic-phonetic analysis of the input signal, to produce a total system for understanding continuous speech. The system contains components for signal analysis, acoustic parameter extraction, acoustic-phonetic analysis of the signal, phonological expansion of the lexicon, lexical matching and retrieval, syntactic analysis and prediction, semantic analysis and prediction, pragmatic evaluation and prediction, and inferential fact retrieval and question answering, as well as synthesized text or spoken output. GRA

N77-26360# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
SPEECH UNDERSTANDING SYSTEMS. VOLUME 2: ACOUSTIC FRONT END Final Report, 30 Oct. 1974 - 29 Oct. 1976
William A. Woods, Madeleine Bates, Geoffrey Brown, Bertram C. Bruce, Craig C. Cook, Laura Gould, Gregory Harris, Dennis H. Klatt, John W. Klovstad, John I. Makhoul et al Dec. 1976 95 p 5 Vol.
(Contract N00014-75-C-0533)
(AD-A035166; BBN-3438-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 17/2

Contents: Acoustic Front End; Acoustic-Phonetic Recognition; A Speech Synthesis-by-Rule Program; and Verification. GRA

N77-26361# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
SPEECH UNDERSTANDING SYSTEMS. VOLUME 3: LEXICON, LEXICAL RETRIEVAL AND CONTROL Final Technical Progress Report, 30 Oct. 1974 - 29 Oct. 1976
William A. Woods, Madeleine Bates, Geoffrey Brown, Bertram C. Bruce, Craig C. Cook, Laura Gould, Gregory Harris, Dennis H. Klatt, John W. Klovstad, and John I. Makhoul Dec. 1976 118 p refs 5 Vol.
(Contract N00014-75-C-0533; ARPA Order 2904)
(AD-A035167; BBN-3438-Vol-3) Avail: NTIS HC A06/MF A01 CSCL 17/2

Contents: Dictionary; Phonological rules; Dictionary Expansions; Lexical Retrieval; Control Strategy; and System Performance. GRA

N77-26362# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
SPEECH UNDERSTANDING SYSTEMS. VOLUME 4: SYNTAX AND SEMANTICS Final Technical Progress Report, 30 Oct. 1974 - 29 Oct. 1976
William A. Woods, Madeleine Bates, Geoffrey Brown, Bertran C. Bruce, Craig C. Cook, Laura Gould, Gregory Harris, Dennis H. Klatt, John W. Klovstad, John I. Makhoul et al Dec. 1976 140 p refs 5 Vol.
(Contract N00014-75-C-0533; ARPA Order 2904)
(AD-A035277; BBN-3438-Vol-4) Avail: NTIS HC A07/MF A01 CSCL 17/2

Contents: Parsers; Grammars; and Prosodics. GRA

N77-26363# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
SPEECH UNDERSTANDING SYSTEMS. VOLUME 5: TRIP Final Technical Progress Report, 30 Oct. 1974 - 29 Oct. 1976
William A. Woods, Madeleine Bates, Geoffrey Brown, Bertram C. Bruce, Craig C. Cook, Laura Gould, Gregory Harris, Dennis H. Klatt, John W. Klovstad, John I. Makhoul et al Dec. 1976

124 p refs 5 Vol.
(Contract N00014-75-C-0533)
(AD-A035278; BBN-3438-Vol-5) Avail: NTIS HC A06/MF A01 CSCL 17/2

Contents: Natural Communication with a Computer; Types of Knowledge Needed; Representations and Processing; Travel Budget Management; Flow of Control; Parsing; Semantic Interpretation; SEMNET - The Network Utility Package; Command Language; Data Base Structure; Discourse Model; Text Response Generation; and Speech Synthesis. GRA

N77-26364# Rome Air Development Center, Griffiss AFB, N.Y.
THE COMPLETE ELECTROMAGNETIC FIELDS IN THE FOCAL REGION OF A PARABOLOIDAL REFLECTOR
Ronald L. Fante and Richard L. Taylor Sep. 1976 21 p refs
(AD-A035052; RADC-TR-76-295) Avail: NTIS HC A02/MF A01 CSCL 09/5

By using the physical optics approximation we have developed a computer program to calculate the complete near field distribution of a paraboloid which is illuminated by a plane wave. This program is described and a number of results obtained with this program are presented, including some comparisons with known result for the fields in the focal plane. GRA

N77-26365# Pacific-Sierra Research Corp., Santa Monica, Calif.
EFFECTS OF ANTENNA ELEVATION AND INCLINATION ON VLF/LF SIGNAL STRUCTURE Final Report, 1 Feb. - 30 Jun. 1976
E. C. Field, M. Lewinstein, and M. A. Dore Dec. 1976 54 p refs
(Contract F19628-76-C-0157; AF Proj. 4603)
(AD-A035510; PSR-612; RADC-TR-76-375) Avail: NTIS HC A04/MF A01 CSCL 17/2

The report analyzes the effects of antenna elevation and inclination on the structure of air-to-air VLF/LF communication signals for frequencies between 15 and 40 KHz. Considered are (1) propagation broadside to the horizontal component of trailing-wire transmitting antennas, and (2) ambient and moderately disturbed daytime ionospheric conditions and ground conductivities of 0.001 and 0.00001 mhos/m. The calculations use full-wave methods, and fully account for the vertical inhomogeneity of the ionosphere and the curvature of the earth. Numerical results are given for the excitation factors, height-gain factors, and attenuation rates of the first few TM and TE modes. Mode summations are carried out, and detailed plots are given for field component versus distance for antenna altitudes between 0 and 40 kft. GRA

N77-26366# Motorola, Inc., Scottsdale, Ariz. Government Electronics Div.
PERFORMANCE OF COHERENT-ON-RECEIVE SYNTHETIC APERTURE SIDE LOOKING AIRBORNE RADAR Final Report, Apr. - Jul. 1976
D. E. Fraser and G. V. Morris Oct. 1976 166 p refs Sponsored in part by Coast Guard and Army
(Contract F42600-75-A-1861)
(AD-A035032; GED-2213; USCG-D-109-76) Avail: NTIS HC A08/MF A01 CSCL 17/9

The Coast Guard's Oil Slick Detection Side Looking Airborne Radar was modified to add a synthetic aperture mode. The modification used the technologies of real time digital synthetic aperture processing and making the existing magnetron transmitter/receiver unit coherent-on-receive. Improvement in resolution by a factor of ten and imaging of the ocean surface and moving vessels were demonstrated. Synthetic oil slicks, generated using Oleyl alcohol, were detected by the synthetic aperture radar at a range of 25 km under 10 knot wind conditions and at 9 km under 4 knot wind. Comparison imagery was taken by a standard AN/APS-94D. The OSDR provided greater detection ranges of oil, due primarily to the higher sea return of the 8-foot vertically polarized antenna of the OSDR. The AN/APS-94D, with the higher gain 16-foot horizontally polarized antenna, detected vessels at longer ranges. Author (GRA)

N77-26367# Mitre Corp., McLean, Va. MATREK Div.
STUDY OF VULNERABILITY OF ELECTRONIC COMMUNICATION SYSTEMS TO ELECTRONIC INTERCEPTION, VOLUME 1
C. W. Sanders, G. F. Sandy, J. F. Sawyer, and A. Schneider Jan. 1977 200 p 2 Vol.
(Contract TP-6AC039)
(PB-264447/4; MTR-7439-Vol-1; OTP-77-06(c)-Vol-1) Avail: NTIS HC A09/MF A01 CSCL 17B

The vulnerability of commonly available electronic communications to unauthorized interception was investigated. Common and specilaized carrier and privately owned communications systems were studied. Various forms of communication such as analog and digital communications carried by dedicated service and switched service systems were analyzed. The transmission modes considered were terrestrial and satellite microwave systems, mobile radio systems and wire and cable (multi-pair and coaxial) systems. The capability required to target a specific person's or corporation's communications and extract the information content of these communications was addressed. GRA

N77-26368# Mitre Corp., McLean, Va. MATREK Div.
STUDY OF VULNERABILITY OF ELECTRONIC COMMUNICATION SYSTEMS TO ELECTRONIC INTERCEPTION, VOLUME 2
C. W. Sanders, G. F. Sandy, J. F. Sawyer, and A. Schneider Jan. 1977 141 p refs 2 Vol.
(Contract TP-6AC039)
(PB-264448/2; MTR-7439-Vol-2; OTP-77-07(c)-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 17B

Additional descriptive background information and the detailed derivations of some of the analyses previously discussed are presented. The descriptive material is given to indicate the variety and complexity of communication systems confronting an interceptor. It also demonstrates the level of sophistication required of potential interceptors. GRA

N77-26369# Naval Postgraduate School, Monterey, Calif.
DIGITAL ENCODING FOR SECURE DATA COMMUNICATIONS M.S. Thesis
Eduardo Emilio Coquis Rondon Sep. 1976 125 p refs
(AD-A035848) Avail: NTIS HC A06/MF A01 CSCL 09/4

This thesis is concerned with the use of the digital computer to realize cryptography. Three cryptographic systems (simple substitution, pseudo-random cipher, polyalphabetic cipher, and data-keyed cipher) are designed, implemented through computer programming, and evaluated. A suitable cyclic error corrections code is designed to encode these systems for transmission. The code is tested by simulating a noisy channel. GRA

N77-26370# North Electric Co., Galion, Ohio.
COMMUNICATIONS PROCESSOR SYSTEM, VOLUME 1, 2, AND 3 Final Technical Report, Jun. 1973 - Mar. 1976
Kenneth Hagstrom and Boris Beizer Jan. 1977 286 p
(Contract F30602-73-C-0314; AF Proj. 4519)
(AD-A036873; RADC-TR-76-394-Vol-1/2/3) Avail: NTIS HC A13/MF A01 CSCL 17/2

This report covers the results of a study to develop a hardware architecture which will be the basis for a family of communications processors for applications processors for application in circuit, message, packet and base communications switch configurations. Over 23 switching equipments were investigated from which a functional baseline was defined for use in the subsequent studies for evolving an advanced Communications Processor System (CPS) architecture. These switches included circuit, message, and packet switching equipments which were felt to be typical of traditional and advanced switching concepts. As an example, the AN/TTC-39, AUTODIN, ARPA Networks were used as part of the circuit, message and packet switching baselines respectively. Air Force Base Communications studies were used as the baseline in that area. From this baseline, a set of fifteen primitive functions were derived which represent the needed capabilities for any generally applied communications processor (CP). This report is organized into eight volumes as follows: Volume 1 - Executive Summary; Volume 2 - Definition of Problem; Volume 3 - Modelling; Volume 4 - CCC Architecture; Volume 5 - CPS Architecture; Volume 6 - Software Generation; Volume 7 - Appendices; and Volume 8 - CPS Central Processor Specification. GRA

N77-26371# North Electric Co., Galion, Ohio.
COMMUNICATIONS PROCESSOR SYSTEM, VOLUME 8 Final Technical Report, Jun. 1973 - Mar. 1976

Kenneth Hagstrom and Boris Beizer Jan. 1977 225 p 2 Vol.
(Contract F30602-73-C-0314; AF Proj. 4519)
(AD-A036874; RADC-TR-76-394-Vol-8) Avail: NTIS HC A10/MF A01 CSCL 17/2

This document is the specification for a Central Processor (CP) which is specifically designed for Communications Processing System (CPS) applications. These CPS applications include: circuit switching, message switching, packet switching, digital multiplexers and concentrators. In this context, CP refers to a set of equipment which contains Communications Processor Units (CPU's), Input/Output (I/O) channels, performance monitor units, channel units, control panels, some form of data and program memory and a means to interconnect them. Therefore, this specification describes a family of computer controlled units which together comprise a CP and which can be equipped in various combinations and numbers to perform, efficiently, any of the CPS applications or any combination of them. GRA

N77-26372# North Electric Co., Galion, Ohio.
COMMUNICATIONS PROCESSOR SYSTEM Final Technical Report, Jun. 1973 - Mar. 1976
Kenneth Hagstrom and Boris Beizer Jan. 1977 283 p refs 2 Vol.
(Contract F30602-73-C-0314; AF Proj. 4519)
(AD-A037159; RADC-TR-76-394) Avail: NTIS HC A13/MF A01 CSCL 17/2

Technical Report, Volume VI is divided into four sections, each section addressing a specific area of the total communications switching system software generation requirements. Section 1 categorizes software components from an operational requirements standpoint, defines the categories, and assesses their impact on the total operating system. Section 2 describes methods for reducing overall cost associated with software development and writing, and identifies the support packages (including software test facilities) necessary to implement the recommended approach. Section 3 describes the system architectural considerations that must be evaluated and implemented in order to effect a consolidated overall systems software approach. Section 4 addresses the requirements necessary to identify, select, and configure circuit and Message Switch software over a variety of physical and functional environments, and describes the facility necessary to implement the reusable software package philosophy. Volume VII consists of five appendixes. GRA

N77-26373# North Electric Co., Galion, Ohio.
COMMUNICATIONS PROCESSOR SYSTEM, VOLUMES 4 AND 5 Final Technical Report, Jun. 1973 - Mar. 1976
Kenneth Hagstrom and Boris Beizer Jan. 1977 334 p 2 Vol.
(Contract F30602-73-C-0314; AF Proj. 4519)
(AD-A037158; RADC-TR-76-394-Vol-4; RADC-TR-76-394-Vol-5) Avail: NTIS HC A15/MF A01 CSCL 17/2

This document is a description of the architecture of the Central Computing Complex (CCC) of the Communications Processing System. The purposes to which this document has been designed are: (a) To provide a tentative specification for a system in concert with the results of the CPS study to date; (b) To identify the potential problem areas and the attendant technical risks for such an architecture; (c) To identify critical design areas that require further study; (d) To recommend the steps that should be taken in succeeding phases of the study so that the CPS architecture can be realized in a cost effective and timely manner. This document is actually two interlaced documents. The shorter of these is of the form of programmer's or system designer's reference manual similar to what might be available to such individuals when implementing a system based on the CPS architecture. The parts belonging to the 'programmer's reference manual' are in normal type and indented. GRA

N77-26374# Illinois Univ., Urbana-Champaign.
THE SINGULARITY EXPANSION REPRESENTATION OF THE TRANSIENT ELECTROMAGNETIC COUPLING THROUGH A RECTANGULAR APERTURE Final Report
L. Wilson Pearson, Kirtland AFB, N. Mex. AFWL Feb. 1977 119 p refs
(Grant AF-AFOSR-2861-75; AF Proj. 1209)
(AD-A036999; AFWL-TR-76-249) Avail: NTIS HC A06/MF A01 CSCL 20/14

The singularity expansion method (SEM) is applied numerically to the electromagnetic dual of the rectangular aperture in a screen of infinite extent--the rectangular plate in free space. The SEM quantities are determined through a numerical treatment of the applicable electric field integral equations, and the details relating to computational efficiency are described. The pole trajectories for the plate are given for a range of aspect ratios, along with natural modes at specimen poles. Physical and numerical interpretations for these data are stated where possible. Author (GRA)

N77-26375# Illinois Univ., Urbana-Champaign. Electromagnetics Lab.
THE SINGULARITY EXPANSION REPRESENTATION OF THE TRANSIENT ELECTROMAGNETIC COUPLING THROUGH A RECTANGULAR APERTURE Interim Report
L. W. Pearson Jun. 1976 123 p refs
(Grant AF-AFOSR-2861-75; AF Proj. 9751)
(AD-A037353; UIEM-76-7; UILU-ENG-76-2551; AFOSR-77-0132TR) Avail: NTIS HC A06/MF A01 CSCL 20/14

The newly developed Singularity Expansion Method (SEM) is applied to the two-dimensional problem of electromagnetic penetration through a rectangular aperture. The SEM quantities for the rectangular plate are determined from the electric field integral equation. Details on computational efficiency are described: Theoretical aspects of coupling coefficients and complex entire functions in the SEM representation are explored. Author (GRA)

N77-26376# Rome Air Development Center, Griffiss AFB, N.Y.
VLF/LF REFLECTIVITY OF THE POLAR IONOSPHERE, 20 JULY - 20 SEPTEMBER 1975
John E. Rasmussen, John P. Turtle, Ralph J. McLain, and Wayne I. Klemetti Oct. 1976 33 p refs
(AD-A036913; RADC-TR-76-327) Avail: NTIS HC A03/MF A01 CSCL 04/1

This report provides a summary of high latitude ionospheric reflectivity as observed by the USAF high resolution VLF/LF ionosounder operating in northern Greenland. Ionospheric reflectivity parameters, including reflection heights and coefficients, are presented as a function of time of day. VLF long path propagation measurements, along with magnetometer and riometer data, are presented as supplemental information. Author (GRA)

N77-26377# Syracuse Univ., N. Y. Dept. of Electrical and Computer Engineering.
STATE-SPACE SOLUTION OF TRANSIENT ELECTROMAGNETIC PROBLEMS Final Technical Report, 1 Aug. 1974 - 31 Dec. 1976
David K. Cheng 31 Jan. 1977 38 p refs
(Grant DAHC04-75-G-0001; DAHC04-76-G-0023)
(AD-A037087; TR-77-3; ARO-11991.1-EL) Avail: NTIS HC A03/MF A01 CSCL 20/3

The transient excitation of a cavity through an aperture is used to illustrate the state-space solution of transient electromagnetic problems. Depending on whether the E- or the H-formulation is used, the effect of the aperture can be accounted for by a magnetic current in invoking the induction theorem or by an electric current in invoking the equivalence theorem. The governing second-order differential equation is converted into a set of first-order state equations by defining three new state variables in addition to an appropriate vector potential. These state equations are soved by the method of moments. Two cases are considered: parallel polarization and perpendicular polarization. Some significant singularities for the parallel-polarization case are found and the electric intensities as functions of time at two locations in the cavity are computed for a step excitation. Author (GRA)

N77-26378# Rome Air Development Center, Griffiss AFB, N.Y.
COMPUTATIONAL STUDY OF LONG-RANGE HIGH-FREQUENCY IONOSPHERIC DUCTING
Kurt Toman and David C. Miller Nov. 1976 22 p refs
(AD-A035502; RADC-TR-76-359) Avail: NTIS HC A02/MF A01 CSCL 20/14

The propagation of high-frequency (HF) signals over long distances by way of ionospheric channels is studied by computing

ray trajectories in numerically specified ionospheres without magnetic field. Horizontal ionization gradients are introduced to provide favorable conditions for the injection rays from the ground into elevated ionospheric ducts. Electron density height distributions with and without ionization valleys are considered. The ducting efficiency, expressed in terms of the product of frequency- and launch elevation-angle interval for trapped rays, is controlled by negative horizontal ionization gradients for successful injection of rays and by the shape of the electron density height profile and its change with distance. Long-range ionospheric ducting of HF rays does not require but is facilitated by the continued presence of an ionization valley in the plane of the ray trajectory. Author (GRA)

N77-26379# Naval Undersea Center, San Diego, Calif.
SPACE/TIME RANDOM PROCESSES AND OPTIMUM ARRAY PROCESSING
Arthur B. Baggeroer Apr. 1976 225 p refs
(AD-A035593; NUC-TP-506) Avail: NTIS HC A10/MF A01 CSCL 09/4

Representations of space/time signals as stationary, homogeneous random processes are used to formulate the theory of optimum array processing. Generalized Fourier expansions for one, two, and three dimensions are discussed. These representations include directional, isotropic signal fields, as well as all previously published ambient noise models. Receiving arrays are modeled in terms of how they observe signal fields with the roles of their geometry and the observation noise analyzed. The design of optimum beamformers is formulated and coupled to the representation of the signal field and the receiving array. The structure of optimum beamforms is analyzed and related to beam displacement, null placement, and superdirective methods. Processing performance obtained by exact methods and approximate methods is compared for various signal fields and array geometries. The closeness of the results indicates the usefulness of the representations and array analysis in predicting the performance of optimum systems. Finally, the structure of performed beams and clustered receiving arrays is analyzed with these methods. Author (GRA)

N77-26380# Georgia Inst. of Tech., Atlanta. School of Electrical Engineering.
ADVANCED MONITORING TECHNIQUES FOR DIGITAL COMMUNICATION SYSTEMS
J. L. Hammond, D. J. Schaefer, S. S. Liu, and B. J. Leon Griffiss AFB, N. Y. RADC Jan. 1977 184 p refs
(Contract F30602-75-C-0118)
(AD-A037082; RADC-TR-77-29) Avail: NTIS HC A09/MF A01 CSCL 17/2

This report considers the problem of monitoring digital communication systems. Possible monitoring techniques are reviewed and a group of different methods, which will completely define the system state, is chosen. A new format violation type indication is suggested and analyzed for the seven-level partial response/FM system. Four-level FM, seven-level partial response/FM and quadrature partial response types of modulation are reviewed and a group of eleven generic faults are chosen as representative malfunctions for communication links using such modulation methods. The response of each of six monitors to each of the generic faults is determined theoretically. Simulation studies are conducted for a seven-level partial response/FM system using three monitors and a selection of typical faults. A method for processing error rate monitor outputs to obtain a fault alarm is worked out and the results are verified with simulation studies. Recommendations are given for a group of five monitors for a seven-level partial response/FM system. Fault isolation cannot be accomplished as well for the four-level FM system because format violation monitors cannot be used. A similar result pertains to the QPR system, although some type of format violation monitor may be possible for this type system. Fault detection can be accomplished for FM and QPR in the same manner as for partial response systems. GRA

N77-26381# Syracuse Univ., N. Y.
ANTENNA SELECT COMPUTER PROGRAM (ANTSEL) Phase Report
Jose Perini and Harvey Schuman Jan. 1977 50 p
(Contract F30602-75-C-0121; AF Proj. 9567)
(AD-A036737; RADC-TR-77-32) Avail: NTIS HC A03/MF A01 CSCL 09/3

The Antenna Select Computer code (ANTSEL) is described here. The code is designed to aid the ship designer in the selection of appropriate antennas at the concept stage of ship design. It is an initial version upon which the feasibility of such codes can be assessed. There are essentially three modes of operation -- Learn, Search, and List. Under Learn Mode, stored antenna data is updated. Under Search Mode, antennas that meet desired specifications are found. Under List Mode, selected antenna data is presented. Listings of two versions of ANTSEL are included here. One version is suited for the Honeywell GCOS timesharing system, the other for the Control Data Corporation timesharing system. Author (GRA)

N77-26382# Rome Air Development Center, Griffiss AFB, N.Y.
A TECHNICAL DESCRIPTION OF THE AUTOMATED TECHNICAL CONTROL (ATEC) SYSTEM AN/GYM-12-(V)
Senatro J. Iuorno Feb. 1977 156 p refs
(AD-A037943; RADC-TR-77-93) Avail: NTIS HC A08/MF A01 CSCL 09/5

This report contains technical descriptions of the Automated Technical Control (ATEC) equipments which comprise the Communications Performance Monitoring-Assessment System AN/GYM-12(V). The AN/GYM-12(V) and its major subsystems provide automated performance monitoring and assessment of communications circuits and equipments in Technical Control Facilities (TCFs) of the Defense Communications System. The heart of the AN/GYM-12(V) is the Nuclear Subsystem (NSS), which provides centralized control for automated performance assessment of communications monitored by a TCF. The ATEC Terminal Elements (ATEs) permit the AN/GYM-12(V) to monitor at any point within the communications network, from a single digital or voice frequency (VF) circuit to a broadband radio link containing many circuits. The performance capabilities and design characteristics of the individual AN/GYM-12(V) equipments are presented in tabular form. Equipment block diagrams and photographs are provided. Applicable ATEC specifications, manuals, reports and other documents are listed. GRA

N77-26383# Cornell Univ., Ithaca, N.Y.
ADVANCED CONCEPTS OF MICROWAVE GENERATION AND CONTROL IN SOLIDS Biannual Report No. 5, 1 Nov. 1975 - 30 Apr. 1976
G. C. Dalman, L. F. Eastman, C. A. Lee, Jeffery K. Frey, and Walter Fu Griffiss AFB, N. Y. RADC Dec. 1976 155 p refs
(Contract F30602-74-C-0001)
(AD-A037945; RADC-TR-76-406) Avail: NTIS HC A08/MF A01 CSCL 09/5

The work accomplished during the fifth biannual period of the program is discussed in this report. Included are: GaAs Read Diodes; Small and Large-Signal Effects on IMPATT Diodes; Measurement of Read and IMPATT Diode Amplifier Parameters; Computer Simulation of TRAPATT Device-Circuit Interactions; High Power, High Efficiency CW TEO's; Automated Network Analyzer; Microwave FET Fabrication Studies; Investigation of Ion Implanted Silicon Read IMPATT Diodes; Broadband GaAs FET Amplifier Study; Optimum Design of Broadband IMPATT Reflection Amplifiers; The Growth and Evaluation of Thin GaAs Layers for Use in Microwave FET's; Experimental and Theoretical Studies of Ion Implanted Silicon Read IMPATT Diode.
Author (GRA)

N77-26384# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Industrial Engineering and Operations Research.
PREDICTION OF MODULATION DETECTABILITY THRESHOLDS FOR LINE-SCAN DISPLAYS Technical Report, 15 Sep. 1973 - 15 Nov. 1975
Robin L. Keesee Wright-Patterson AFB, Ohio AMRL Dec. 1976 120 p refs
(Contract F33615-71-C-1739)
(AD-A035735; AMRL-TR-76-38) Avail: NTIS HC A06/MF A01 CSCL 06/16

Determination of the modulation detectability threshold for sinusoidal gratings is a prerequisite to several measures of image quality for line-scan imaging systems. To develop predictive models for these thresholds, an experiment was conducted to determine

the modulation detectability threshold functions for a range of system parameters typical of medium- to high-resolution low-light-level television systems. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N77-26385* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PROCESS FOR PREPARING LIQUID METAL ELECTRICAL CONTACT DEVICE Patent

Robert R. Lovell, Frank D. Berkopec, and David H. Culp, inventors (to NASA) Issued 17 May 1977 4 p Filed 24 Jul. 1976 Supersedes N76-29490 (14 - 20, p 2591)
(NASA-Case-LEW-11978-1; US-Patent-4,023,266; US-Patent-Appl-SN-708658; US-Patent-Class-29-628; US-Patent-Class-29-597; US-Patent-Class-29-622; US-Patent-Class-29-630E; US-Patent-Class-204-32A) Avail: US Patent Office CSCL 09A

The parts of an electrical contact device are treated by sputter etching to remove the parent metal oxide. Prior to exposure of the electrodes to any oxygen, a sacrificial metal is sputter deposited on the parts. Preferably this sacrificial metal is one that oxidizes slowly and is readily dissolved by the liquid metal. The sacrificial metal may then be removed from unwanted areas. The remainder of the ring and the probe to be wet by the liquid metal are submerged in the liquid metal or the liquid metal is flushed over these areas, preferably while they are being slightly abraded, unitl all the sacrificial material on these portions is wet by the liquid metal. In doing so the liquid metal dissolves the sacrificial metal and permanently wets the parent metal. Preferred materials used in the process and for the electrodes of electrical contact devices are high purity (99.0%) nickel or AISI type 304 stainless steel for the electrical contact devices, gallium as the liquid metal, and gold as the sacrificial material.
Official Gazette of the U.S. Patent Office

N77-26386* National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.

THREE PHASE FULL WAVE DC MOTOR DECODER Patent

Phillip A. Studer, inventor (to NASA) Issued 31 May 1977 7 p Filed 3 Jun. 1975 Supersedes N75-27254 (13 - 18, p 2238)
(NASA-Case-GSC-11824-1; US-Patent-4,027,212; US-Patent-Appl-SN-583486; US-Patent-Class-318-138; US-Patent-Class-318-254; US-Patent-Class-318-227) Avail: US Patent Office CSCL 09C

A three phase decoder for dc motors is disclosed which employs an extremely simple six transistor circuit to derive six properly phased output signals for fullwave operation of dc motors. Six decoding transistors are coupled at their base-emitter junctions across a resistor network arranged in a delta configuration. Each point of the delta configuration is coupled to one of three position sensors which sense the rotational position of the motor. A second embodiment of the invention is disclosed in which photo-optical isolators are used in place of the decoding transistors. Official Gazette of the U.S. Patent Office

N77-26387* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

ELECTRO-MECHANICAL SINE/COSINE GENERATOR Patent

Bruce Flagge, inventor (to NASA) Issued 19 Nov. 1974 5 p Filed 13 Mar. 1973 Supersedes N73-32121 (11 - 23, p 2765) Continuation-in-part of abandoned US Patent-Appl. SN-229143, filed 24 Feb. 1972
(NASA-Case-LAR-11389-1; US-Patent-3,849,720; US-Patent-Appl-SN-340862; US-Patent-Class-322-96; US-Patent-Class-310-111; US-Patent-Class-310-168; US-Patent-Appl-SN-229143) Avail: US Patent Office CSCL 09A

An electromechanical device is described for generating both sine and cosine functions. A motor rotates a cylinder about an axis parallel to and a slight distance from the central axis of the cylinder. Two noncontacting displacement sensing devices are placed ninety degrees apart, equal distances from the axis of rotation of the cylinder and short distances above the surface of cylinder. Each of these sensing devices produces an electrical signal proportional to the distance that it is away from the cylinder. Consequently, as the cylinder is rotated, the outputs from the two sensing devices are the sine and cosine functions.
Official Gazette of the U.S. Patent Office

N77-26388+ Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France). Dept. d'Etudes et de Recherches en Technologie Spatiale.

ELECTROSTATIC CHANGING AND DISCHARGE PHENOMENA OBSERVED IN GEOSYNCHRONOUS ORBIT. A BIBLIOGRAPHY [BIBLIOGRAPHIE SUR LES PHENOMENES DE CHARGE ELECSTROSTATIQUE ET DE CLAQUAGES OBSERVES EN ORBITE GEOSYNCHRONE]

L. Levy and A. Paillous Feb. 1977 39 p In FRENCH
(ONERA-DERTS-NT-03-11) Avail: NTIS HC A03

Results of a bibliographic study covering literature until the end of 1976 are presented. Correlation between geomagnetic events and incidents observed in geosynchronous orbit was established. Mechanisms are proposed for charging of the dielectric surfaces and the discharges resulting. Modeling principles are described. The behavior of certain materials is documented. The manifestations of discharges as well as precautions to be taken to minimize their effects, are indicated. ESA

N77-26389# Colorado State Univ., Fort Collins. Dept. of Chemistry.

SQUARE WAVE VOLTAMMETRY AT THE DROPPING MERCURY ELECTRODE, THEORETICAL

J. H. Christie, John A. Turner, and R. A. Osteryoung Feb. 1977 29 p refs
(Contract N00014-77-C-0004)
(AD-A035970; TR-2) Avail: NTIS HC A03/MF A01 CSCL 07/4

The theoretical aspects of square voltammetry at the dropping mercury electrode are presented. The technique involves scanning the entire potential range of interest on a single drop of a DME. Asymmetries in the waveform as well as variations in current measurement parameters are discussed. Indications are that previous uses of the waveform may not have utilized all its capabilities. Author (GRA)

N77-26390# Stanford Research Inst., Menlo Park, Calif.

AN INVESTIGATION OF BASIC NOISE PROPERTIES OF FIELD EMISSION Final Report, 1 Jan. 1973 - 31 Dec. 1976

John Kelly 1977 6 p refs
(Contracts DAAG29-73-C-0007)
(AD-A037094; ARO-11101.4-EL) Avail: NTIS HC A02/MF A01 CSCL 09/1

Our physical understanding of the mechanism of operation of the TFFE cathodes have been considerably improved over the period of this contract. From the point of view of future practical applications we have demonstrated lifetimes in excess of 15,000 hours are obtained in conventional ion-pumped vacua at currents of 20 microamp/cone; although the low frequency noise is considerably higher than for thermionic emission, it is still well within the requirements of all but very low noise devices; and the basic properties of the arrays of cathodes are such that they can be successfully applied to devices where small area, high current density cathodes are required, with long life and no auxillary power. The work carried out under this contract has demonstrated that the development of the TFFEC represents an important breakthrough in making practical the use of cold field emission cathodes in actual tubes. GRA

N77-26391# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.

THE COPLANAR ELECTRON TUBE

Mortimer H. Zinn Dec. 1976 48 p refs
(AD-A037138; Rept-76-2) Avail: NTIS HC A03/MF A01 CSCL 09/1

Coplanar electron tubes consisting of emitting, controlling and collecting electrodes on a single heated plane have been proposed as a method of achieving high temperature and high radiation resistant devices. In order to design these devices, the scaling laws must be obtained. Using computer techniques it was determined that while the plate current of a device still followed a general three-halves power curve, the effect of electrode areas and electrode spacing are far less pronounced then in multiplanar tubes. A number of auxiliary problems were studied and data was obtained indicating that both alumina and beryllia would be suitable substrates for these devices. Single crystal alumina (sapphire) was found to be satisfactory, but polycrystalline alumina was not, indicating some reaction with active material from the cathode. Polycrystalline beryllia, on the other hand, was satisfactory. A trough strip line was developed for use in a distributed amplifier, power coplanar tetrode, but time did not permit, nor did results warrant, the construction of such a device. Author (GRA)

N77-26392# Los Alamos Scientific Lab., N. Mex.
PRINCIPAL CONSIDERATIONS IN LARGE ENERGY-STORAGE CAPACITOR BANKS
E. L. Kemp 1976 11 p refs Presented from IEEE Intern. Pulsed Power Conf., Lubbock, Tex., 10 Nov. 1976
(Contract W-7405-eng-36)
(LA-UR-76-2387; Conf-761106) Avail: NTIS HC A02/MF A01

Two large capacitor banks, Scyllac at Los Alamos and Shiva at Livermore, are used as models of large, complex systems. Scyllac is a 10-MJ, 60-kV theta-pinch system while Shiva is a 20-MJ, 20-kV energy system for laser flash lamps. A number of design principles are emphasized for expediting the design and construction of large banks. The sensitive features of the charge system, the storage system layout, the switching system, the transmission system, and the design of the principal bank components are presented. Project management and planning must involve a Pert chart with certain common features for all the activities. The importance of the budget is emphasized. ERA

N77-26393# Avco-Everett Research Lab., Everett, Mass.
CDIF COMBUSTOR DESIGN Final Report
D. B. Stickler and R. T. Barnes Jun. 1976 81 p refs
(Contract W-31-109-eng-38)
(TID-27143) Avail: NTIS HC A05/MF A01

Magnetohydrodynamic (MHD) electric power development offers a major opportunity for better utilization of U.S. coal supplies. Conceptual studies of MHD power systems project coal pile to bus bar plant efficiencies up to 50 percent better than modern steam cycles and 20 to 30 percent better than advanced combined gas turbine-steam turbine cycles. MHD offers further potential advantages in control of environmental emissions. The MHD Development Program established by ERDA for meeting the goal of commercial MHD demonstration by the late 1980's progresses through four overlapping phases, each focused firmly on the eventual commercial requirements. The initial phase will develop the technology required to design, develop and demonstrate subscale system components and subsystems. This report addresses one aspect of the initial phase of the ERDA MHD overall development plan and that is the develcpment of a combustor conceptual design for testing in the CDIF. The CDIF combustor design is capable of ultimately being increased in size to a 2,000 MW thermal MHD commercial plant. ERA

N77-26394# California Univ., Berkeley. Lawrence Berkeley Lab.
EXCESS NOISE IN SELECTED FIELD-EFFECT TRANSISTORS
Jorge Llacer and D. F. Meier Oct. 1976 12 p refs Presented at Nucl. Sci., Scintillation and Semicond. Counter Symp., New Orleans, 20 Oct. 1976
(Contract W-7405-eng-48)
(LBL-5567; Conf-761006-31) Avail: NTIS HC A02/MF A01

The origin of excess noise in high-quality FETs (Field Effect Transistors) is investigated in the frequency domain. It is found that, for use in opto-feedback systems, generation-recombination noise through deep traps is important. It is shown that best initial characterization of transistors for that use can be done in a grounded gate configuration. The activation energy of the principal traps responsible for the noise is calculated, and tentative identification of the responsible impurities or defects is made. It is also shown that the basic low temperature limit of Si FET operation is set by majority carrier freeze out at chip temperatures well above 100 K and that boron nitride mounts at temperatures above 77 K can contribute 10 to 15 eV of 1/f noise. ERA

N77-26395# Addis Translations International, Portola Valley, Calif.
WATER AS DIELECTRIC IN HIGH-VOLTAGE IMPULSE DEVICES
V. Ya. Ushakov 1974 35 p refs Transl. into ENGLISH from the book "Powerfull nanosecond sources of accelerated electrons", Novosibirsk, Izdatel'stvo Nauka, 1974 p 96-113 Sponsored by ERDA
(UCRL-Trans-11185; LLL-02222) Avail: NTIS HC A03/MF A01

In exploding wire and ultrafast plasma heating experiments, for the production of high power X-ray flashes and fast electron pulses, and in a number of other situations, generators of large impulse currents and voltages with nanosecond fronts are needed. The results on the principal aspects of the use of water as a dielectric in high-voltage impulse storage and switching devices are summarized. Author (ERA)

N77-26396# Sandia Labs., Albuquerque, N. Mex.
EVALUATION OF AN ADAPTIVE FILTER AS A DIGITAL TRACKING FILTER
D. O. Smallwood and D. L. Gregory 1976 28 p refs Presented at the 47th Shock and Vibration Symp., Albuquerque, N. Mex., 19 Oct. 1976
(Contract E(29-1)-789)
(SAND-76-5668; Conf-761062-4) Avail: NTIS HC A03/MF A01

An adaptive filter is developed for use as a digital tracking filter. The filter is nonrecursive with two weights. The weights are changed in response to an error signal; the error signal is driven to a minimum mean square value. It is shown that the tracking filter is easy to implement (4 multiply adds/stage/sample point) and effective. The filter theory and characteristics are discussed, and several examples are presented. ERA

N77-26397# Sandia Labs., Albuquerque, N. Mex.
RELUCTANCE TECHNIQUE FOR APPROXIMATING THE PERFORMANCE OF LARGE AIR GAP TRANSFORMERS
Roger P. Roberts Nov. 1976 47 p refs
(Contract E(29-1)-789)
(SAND-76-0589) Avail: NTIS HC A03/MF A01

A magnetic path reluctance for approximating the characteristics of transformers with large air gaps which can exceed some dimensions of the core itself was developed. All known standard references for the magnetics designer will stop short of truly large air gaps leaving a void for the designer with special air gap requirements. By application of the simple relationships developed the designer can approximate the transformer performance from manufacturer's catalog information thus reducing costs and time required by shortening the iterative building processes. ERA

N77-26398# California Univ., Livermore. Lawrence Livermore Lab.
CCD INTEGRATED CIRCUIT FOR TRANSIENT RECORDERS
Joseph W. Balch and Charles F. McConaghy 11 Oct. 1976 7 p refs Presented at the NASA-JPL Conf. on Charge Coupled Device Technol. and Appl., Washington, D. C., 30 Nov. - 2 Dec. 1976
(Contract W-7405-eng-48)
(UCRL-78360; Conf-761117-1) Avail: NTIS HC A02/MF A01

A 50 MHz CCD integrated circuit is described that was developed for use in transient analog signal recorders to sample and time expand transient signals. The integrated circuit achieves an effective 200 MHz sample rate by using four 32 stage peristaltic CCDs to sample the transient signal four times each clock

period. Dual frequency, 4 phi clocking is used to sample and time expand the sampled data. The output signals of the four CCDs are multiplexed on-chip into a single low frequency output data line. When operated with 50 MHz/165 KHz 4 phi clocks, this circuit has a 200 MHz sample rate, a record length of 640 nanoseconds, a time expansion factor of 303, and overall signal to noise ratio of 40:1. The signal to noise ratio is limited by fixed pattern noise of the four CCDs. ERA

N77-26399# European Space Research and Technology Center, Noordwijk (Netherlands).
COMPUTER-AIDED ANALYSIS OF ELECTRONIC FILTERS
J. K. Nielsen Paris ESA Mar. 1977 72 p refs
(ESA-TM-171) Avail: NTIS HC A04/MF A01

The ESA computer program for electric filter analysis (FILTEN) is presented. At present, the program can perform analysis on bandpass filters of the following types: Butterworth, Chebyshev, elliptic function, and special purpose filters for which the locations of the poles and zeroes in the complex frequency plane are known. The program can interface with a series of programs in the ESTEC MODSIM system. Author (ESA)

N77-26400# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
ON THE CALCULATION OF PERMEANCES AND FORCES BETWEEN DOUBLY SLOTTED STRUCTURES
A. J. C. Bakhuizen and R. DeBoer Sep. 1976 117 p refs
(TH-76-E-65; ISBN-90-6144-065-3) Avail: NTIS HC A06/MF A01

An investigation is described of the influence of the shape of the teeth on permeance and on the tangential force-displacement curves of slotted structures for electric motors with slots in stator and rotor, e.g., stepping motors. The influence of varying slot depth was calculated for rectangular teeth, followed by a calculation of the influence of rounded slots. The influence of the toothwidth/toothpitch ratio was investigated, the slot depth being kept constant. These calculations were carried out for three assumed material conditions, viz.: ideal iron, i.e., iron with infinite permeability; normal iron, i.e., iron with a finite, non-constant permeability, excluding the influence of hysteresis and saturation of the teeth; and normal iron, now also considering the influence of eventual saturation of the teeth. A measuring device by which the calculated force-displacement curves are verified is also described. These measurements were carried out for five different air gap values, seven different toothwidths, and eight values of the excitation. A comparison between the calculations and measurements was made and conclusions drawn regarding the most suitable toothwidth for slotted structures. Author (ESA)

N77-26401# Interuniversitair Reactor Instituut, Delft (Netherlands).
FUNCTION GENERATOR USED FOR DYNAMIC DEPOLARIZATION EXPERIMENT [DE FUNCTIEGENERATOR GEBRUIKT BIJ HET DYNAMISCH DEPOLARISATIE EXPERIMENT]
F. J. VanSchaik 1976 18 p Partly in DUTCH and ENGLISH
(IRI-132-76-03) Avail: NTIS HC A02/MF A01

A function generator is described which produces three signal shapes: a square signal, a triangular signal, and a constant level. The generator was designed for a dynamic depolarization experiment to produce a time dependent magnetic field through a power amplifier. An initial starting pulse is also generated for each signal period. The circuit diagram, separated into the digital and analog part, is dealt with. The results are presented. ESA

N77-26402# European Space Agency, Paris (France).
FUNCTIONING OF POWER RECTIFIERS AND THYRISTORS
Joachim Burtscher, F. Dannhaeuser, J. Krausse, H. Strack, P. Voss et al May 1977 37 p refs Transl. into ENGLISH of 'Wirkungsweise von Leistungsgleichrichtern u. Thyristoren', Siemens A. G., Munich Report BMFT-FB-T-76-51, Oct. 1976 Original report in GERMAN previously announced as N77-17375 Original GERMAN report available from ZLDI, Munich DM 8,40
(ESA-TT-389; BMFT-FB-T-76-51) Avail: NTIS HC A03/MF A01

The influence of the recombination properties of the different silicon layers in power rectifiers and thyristors of the forward characteristics and the dynamic behavior is discussed quantitatively, taking into account Auger recombination. This leads to more exact dimensioning guidelines for the development of technical devices. A scaling down of the arrangement of the shorts in shorted emitters of thyristors improves the dv/dt capability and recovery time but leads to an impaired plasma spreading. The conditions needed to avoid current channelling at thyristor turn-on were investigated. A thyristor that can be ignited by exceeding its breakover voltage was developed, as well as a thyristor for 10 kHz applications and thyristor that turns on without current channelling. Insight into the processes taking place inside power rectifiers during commutation was gained with a simple theoretical model. Author (ESA)

N77-26403# Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.
DEVELOPMENT OF AN INTEGRATED POWER MODULE INVERTER Final Technical Report, 9 Sep. 1974 - 30 Oct. 1976
30 Oct. 1976 113 p refs Prepared in cooperation with Rec-Tec, Inc., Fairfield, Conn.
(Contract DAAK02-75-C-0101)
(AD-A035815) Avail: NTIS HC A06/MF A01 CSCL 10/2

This research project was established to provide a cost effective, reliable and efficient converter using an integrated power switch with pulse width modulation techniques. Low cost, light weight and efficient converter systems are highly suitable and offer weight and quality advantages in portable frequency conversion and power control systems. This particular program is for the development of a 15 KW three phase inverter system which can convert unregulated, poor quality, input power into good quality, three phase power at 50, 60 and 400 Hz. Much success has been achieved toward the intended objectives and the program. However, it must be recognized that when a radically new technology using techniques which effectively reduce system weight as much as 67%, some problems arise which reduce the available time to allow for completion of all goals set forth in this best efforts program. This report states what was accomplished, how it was accomplished, and conclusions and recommendations for further work effort. GRA

N77-26404# Army Electronics Command, Fort Monmouth, N. J.
PROCEEDINGS OF THE ECOM HYBRID MICROCIRCUIT SYMPOSIUM, 1976
Owen P. Layden and Isaac H. Pratt Jun. 1976 415 p refs
Conf. held at Ft. Monmouth, N. J., 8-9 Jun. 1976
(AD-A035246) Avail: NTIS HC A18/MF A01 CSCL 09/5

Papers discuss application of hybrid microcircuits in Army communication and surveillance and other military and government equipment. Hybrid microcircuit process and quality control documents and guides are described and qualification requirements for thick film networks and epoxy adhesives defined. Automation of a hybrid microcircuit line, non-wire bonding techniques, ruggedization and standard electronic modules are detailed.
Author (GRA)

N77-26405# Army Electronics Command, Fort Monmouth, N. J. Electronics Technology and Devices Lab.
LOW TEMPERATURE PRESSURE-OXIDATION OF SILICON FOR INTEGRATED CIRCUIT TECHNOLOGY
Robert J. Zeto, Clarence G. Thornton, Eugene Hryckowian, and Charles D. Bosco Jan. 1977 19 p refs Presented at 10th Army Sci. Conf., West Point, N. Y., 23 Jun. 1976
(DA Proj. 1T1-61101-A-91-A; DA Proj. 1L1-61102-AH-47)
(AD-A035266; ECOM-4459) Avail: NTIS HC A02/MF A01

It was reasoned that dry oxygen pressures above 1 atm would appreciably accelerate the oxidation of silicon, thereby leading to lower oxidation temperatures, reduced defect concentrations, and improved electrical properties. Special apparatus has been developed, and careful experimentation has demonstrated that oxidation temperatures can be lowered as much as 400 C by using only 140 atm dry oxygen pressure, i.e., a pressure lower than that contained in commercial bottled gas cylinders. Measurements have shown that the resultant oxidized material has a stable flat-band voltage, consistently low fixed surface-state-charge density, high dielectric strength, and a generally lower defect concentration relative to conventionally processed silicon.

The use of pressure-oxidation (P-OX) to obtain oxide-isolated integrated circuits on sapphire to meet military requirements for low power and radiation hardening was demonstrated. GRA

N77-26406# Georgia Inst. of Tech., Atlanta.
COMPUTIONAL TECHNIQUES FOR THE REDUCTION OF NONLINEAR EFFECTS USING PASSIVE COMPENSATING NETWORKS Phase Report, 1 Oct. 1974 - 1 Jul. 1976
Kendall L. Su Griffiss AFB, N. Y. RADC Dec. 1976 99 p refs
(Contract F30602-75-C-0118; AF Proj. 4540)
(AD-A035855; RADC-TR-76-369) Avail: NTIS HC A05/MF A01 CSCL 09/5

The objective of this effort is to develop design procedures to minimize nonlinear effects in mildly nonlinear circuits--specifically, design procedures that will reduce nonlinear distortions such as intermodulation, desensitization, gain compression, etc. in communication equipment. The approach used relies on reducing in-band nonlinear distortion products by modifying the first order transfer functions outside the band of interest. The technique makes use of the fact that certain high-order nonlinear effects in the passband are functions of first-order network parameters at frequencies outside the band. By appropriate modification of these first-order parameters in-band, nonlinear effects can be reduced. GRA

N77-26407# Delta Electronic Control Corp., Irvine, Calif.
TRADE-OFF INVESTIGATIONS AND DETAILED DESIGN OF POWER INVERTERS Final Report, Jan. 1976 - Jan. 1977
W. G. Lawrence Jan. 1977 97 p
(Contract DAAG53-76-C-0077)
(AD-A036027; DECC-61131-002) Avail: NTIS HC A05/MF A01 CSCL 10/2

An investigation to determine the optimum design for modular family of power inverters has been completed. The inverters are to provide 60 Hz for 400 Hz selectable sine wave outputs at 120 V/240 V, single phase/3-phase when supplied from a 30-60 Vdc source. Included in the family are inverters of from 1.5 to 10 KW. Optimization is done with regard to cost, size, weight, efficiency, reliability, availability and maintainability. Various options were examined during Phase I. Phase II detailed study. GRA

N77-26408# California Univ., Berkeley. Lawrence Berkeley Lab.
OPTIMIZING PATH PRINTED CIRCUIT BOARD ROUTER
Michael F. Kelly and Robert J. Smith, II 19 Nov. 1976 7 p refs Presented at the 1976 Asilomar Conf. on Circuits, Systems and Computers, Asilomar, Calif., 22-24 Nov. 1976
(Contract W-7405-ENG-48)
(UCRL-78564; Conf-761120) Avail: NTIS HC A02/MF A01

A printed circuit interconnection router which combines the macro-cell topological orientation of classical channel routers with exhaustive breadth-first search capabilities of traditional wave front expansion is described. Details of implementation and some example layouts are shown to demonstrate the routers' ability to yield 90 percent or more of connections required on a variety of two layer boards. ERA

N77-26409# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala.
A DIGITAL DETECTOR WITH SELECTABLE PASSBAND
Richard A. Lane 3 Jan. 1977 37 p refs
(AD-A035604; RC-77-2) Avail: NTIS HC A03/MF A01 CSCL 09/5

Digital filters and detection techniques are used in many modern communication and control circuits. Such digital techniques are valued for ease of realization and implementation as well as for clean and precise logical outputs. A digital detector can be designed with standard logic family components capable of detecting the center frequency, F sub C, and bandpass, B, using standard Karnaugh mapping techniques. An internal oscillator at frequency F sub o, provides a counting sequence C, to an n- Bit counter which provides the basis for nonsymmetrical near ideal filter. The basis of the filter is implemented on an n-variable Karnaugh map with the center frequency selected as the middle cell in an odd cellular array and the bandpass selected as the width of this cellular combination. Because standard Karnaugh mapping is used, the design process and logic relation is simplified by using a two level logic. Author (GRA)

N77-26410# RCA Labs., Princeton, N. J.
X-BAND POWER FET DEVELOPMENT Final Report, 1 Dec. 1975 - 31 Dec. 1976
H. C. Huang 31 Dec. 1976 38 p refs
(Contract DAAH01-76-C-0357)
(AD-A035642; PRRL-76-CR-61) Avail: NTIS HC A03/MF A01 CSCL 09/5

Techniques for cellular combining at X-band frequencies to increase the output power have been developed. Multicell FETs have been fabricated and evaluated. Several multicell FETs with an output power of 800 to 900 MW, a small signal gain of 5 db, and a power-added efficiency of 7 to 20% at the 9- to 10- GHz band have been delivered to the contracting agency. The performance of these devices meets the goals of this program. Author (GRA)

N77-26411# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
FORWARD REASONING AND DEPENDENCY-DIRECTED BACKTRACKING IN A SYSTEM FOR COMPUTER-AIDED CIRCUIT ANALYSIS
Richard M. Stallman and Gerald Jay Sussman Sep. 1976 71 p refs
(Contract N00014-75-C-0643)
(AD-A035719; AI-M-380) Avail: NTIS HC A04/MF A01 CSCL 09/3

A rule-based system is presented for computer-aided circuit analysis. The set of rules, called EL, is written in a rule language called ARS. Rules are implemented by ARS as pattern-directed invocation demons monitoring an associative data base. Deductions are performed in an antecedent manner, giving EL's analysis a catch-as-catch-can flavor suggestive of the behavior of expert circuit analyzers. This style of circuit analysis is called propagation of constraints. The system threads deduced facts with justifications which mention the antecedent facts and the rule used. These justifications may be examined by the user to gain insight into the operation of the set of rules as they apply to a problem. The same justifications are used by the system to determine the currently active data-base context for reasoning in hypothetical situations. They are also used by the system in the analysis failures to reduce the search space. This leads to effective control of combinatorial search which is called dependency-directed backtracking.

N77-26412# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Electrical and Systems Engineering.
INTERFACE STATES IN SCHOTTKY BARRIER DIODES Final Report, 28 Jun. 1974 - 31 Dec. 1975
Jose M. Borrego, Ronald J. Gutmann, and S. Ashok Aug. 1976 79 p refs
(Contract F19628-76-C-0102)
(AD-A035720; RADC-TR-76-267) Avail: NTIS HC A05/MF A01 CSCL 09/1

Gallium arsenide Schottky barrier junctions have become increasingly important in a wide variety of high performance GaAs microwave devices such as IMPATT diodes, Schottky gate FET's and RF detectors. Although neutron irradiation effects on silicon Schottky barrier junctions are well documented no detailed results have been reported for GaAs Schottky junctions. The purpose of this program was to explore the effect of fast neutron irradiation on the metal semiconductor interface and the resultant performance of Schottky barrier including transient ionizing radiation. Device changes at neutron fluences where the reduction in the free carrier concentration is less than 20% were emphasized, as larger reductions in free carrier concentration l lead to gross changes in junction properties that cannot be tolerated in most applications. Gold and aluminum were selected as the metals for forming the Schottky junctions since there is a large variety of results for Au-GaAs Schottky junctions reported in the literature, which could be used for comparison purposes, and because the Al-GaAs junction has a lower barrier height and appears to be more stable than the Au-GaAs interface. GRA

N77-26413# Illinois Univ., Urbana-Champaign. Materials Research Lab.

RESEARCH IN MATERIALS SCIENCE Final Technical Report
Robert J. Maurer Jan. 1977 56 p refs
(Contract F44620-75-C-0091; ARPA Order 3009)
(AD-A037760; AFOSR-77-0161TR) Avail: NTIS HC A04/MF A01 CSCL 20/12

The quaternary semiconductor In(1-x)Ga(x)p(1-z)As(Z) has been exploited to construct light emitting and laser diodes with selective emission from the yellow of the visible spectrum to the infrared. The properties of deep traps which affect the performance of silicon devices has been characterized. Molecular interactions and fast atomic motion has been investigated in liquids, liquid crystals, organic semiconductors, ionic superconductors, layered dichalcogenides and superconductor alloys.
Author (GRA)

N77-26414# Raytheon Co., Waltham, Mass. Research Div.
MANUFACTURING METHODS AND TECHNOLOGY MEASURES FOR ARC-PLASMA-SPRAYED PHASE-SHIFTER ELEMENTS Quarterly Progress Report, 1 Oct. - 31 Dec. 1976
H. J. VanHook, D. Masse, and J. Saunders Jan. 1977 110 p
(Contract DAAB07-75-C-0043)
(AD-A037238; S-2156; QPR-6) Avail: NTIS HC A06/MF A01 CSCL 09/5

Seventy-eight plasma spray runs were made during this quarter. Half of these (39) were machined to phase-shifter dimensions and annealed before and after machining. Microwave testing was completed on 10 of these. For samples produced in the latter part of the quarter typical values of microwave phase shift are 370 deg - 420 deg, a considerable improvement over the previous quarter (approximately 300 deg) and above the contract specifications of 340 deg saturation phase shift. Insertion loss in these phase shifters in 0.6 1.5 db within the range of the contract goal (1 db). We attribute the improved performance to refinements in vendor machining to give uniform ferrite wall thickness and improvements in spray techniques which have reduced cracking, and the avoidance of distortions during spraying due to temperature and alignment problems. Development of an X-ray fluoroscopic technique for nondestructive sample analysis has been invaluable in sorting out the courses of poor magnetic properties in earlier samples. Author (GRA)

N77-26415# Rockwell International Corp., Cedar Rapids, Iowa. Collins Radio Group.
HIGH STABILITY TEMPERATURE COMPENSATED CRYSTAL OSCILLATOR STUDY Final Report, 28 Feb. 1975 - 29 Feb. 1976
Alan B. Mroch and Glenn R. Hykes Feb. 1977 101 p refs
(Contracts DAAB07-73-C-0137; DAAB07-71-C-013; DA Proj. 1S7-62750-AH-94)
(AD-A036908; ECOM-73-0137-F) Avail: NTIS HC A06/MF A01 CSCL 09/5

A miniature high-stability temperature-compensated crystal oscillator (HSTCXO) has been developed with new features for eventual use in SSB communications equipment. These new features are a wider temperature range for the same temperature stability (+ or - 5 pp to 10 the 8th power from -46 to +85 C), single supply (10 + or - 0.5 V), low power consumption (less than 100 mW), a CMOS compatible output (10 V square wave) and small size, 2.75 in X 1.5 in X 0.5 in (6.98 cm X 3.81 cm X 1.27 cm). Other important features of the HSTCXO are a 50-ohm output (0.125 V rms), insensitivity to load variations and voltage variations (+ or - 5 pp 10 to the 9th power), and fast warmup (1 pp 10 to the 8th power of final frequency in 1 minute). The TCXO uses a conventional analog thermistor network of coarse compensation and a CMOS digital fine correction systems with a programmable memory for fine compensation. A computer data interpolation method is used to minimize the required number of data points for fine correction.
Author (GRA)

N77-26416# California Univ., Livermore. Lawrence Livermore Lab.
APPROXIMATIONS FOR TERMS RELATED TO THE KERNEL IN THIN-WIRE INTEGRAL EQUATIONS Final Report
A. J. Poggio and R. W. Adams Jan. 1977 44 p refs
(AF Proj. 3763)
(AD-A036729; AFWL-TR-76-98) Avail: NTIS HC A03/MF A01 CSCL 20/3

Difficulties can arise in the evaluation of elements in the impedance matrix associated with a moment-method solution of the thin-wire electric field integral equation. The results of a detailed study are presented and several representations are considered and compared. From information regarding errors, regions of acceptability are obtained. The deficiencies in the thin-wire kernel are clearly illustrated and remedies are suggested.
Author (GRA)

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N77-26417 British Library Lending Div., Boston Spa (England).
SIMULATION OF SUB-SPAN GALLOPING OF BUNDLED CONDUCTORS: A SIMPLIFIED MODEL
A. Curami and R. Riva [1976] 21 p refs Transl. into ENGLISH from Energia Elettrica (Italy), v. 53, no. 4, 1976 p 216-224
(BLL-CE-Trans-7067-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

Sub-span oscillation is discussed as a phenomenon of instability due to flutter which results from the aerodynamic coupling of the vertical and horizontal frequencies. Simulation on a simplified model is demonstrated.
F.O.S.

N77-26418 British Library Lending Div., Boston Spa (England).
CALCULATION OF THE HEAT TRANSFER TO BOILING REFRIGERATORS
K. Stephan Mar. 1977 12 p refs Transl. into ENGLISH from Kaltetechnik (W. Germany), v. 15, no. 8, 1963 p 231-234
(BLL-RTS-9959) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

A generally valid dimensionless law for analysis of boiling heat transfer to boiling liquids is used to obtain simple relations and diagrams which are suited to determining coefficients of heat transfer to boiling refrigerants.
Author

N77-26419 British Library Lending Div., Boston Spa (England).
HEAT TRANSFER AND PRESSURE LOSS CAUSED BY COOLANT VAPORIZATION IN A HORIZONTAL STREAM TUBE
J. M. Chawla Mar. 1977 23 p refs Transl. into Chem. Ing. Tech. (Heidelberg), v. 40, no. 5, 1968 p 229-234
(BLL-RTS-9956) Avail: British Library Lending Div., Boston Spa, Engl.: £15.00; 14 BLL overseas, 15 European or 60 UK BLL photocopy coupons

An evaporator tube can be divided into two sharply defined lengths in which the local heat transfer is determined by different laws. When the heat input exceeds the amount that can be transferred from the wall to the coolant by pure convection, vaporization commences. The general relationships for local heat transfer and local pressure drop are summarized in working tables, from which simple determinations can be made of the average heat-transfer coefficient and the overall pressure loss for vaporization in horizontal tubes. The effect of machine-oil contamination in the coolant is covered by a correction factor.
Author

N77-26420 British Library Lending Div., Boston Spa (England).
THE ZIG ZAG CLASSIFIER: A WINDSIFTER WITH A NOVEL CLASSIFYING PRINCIPLE
F. Kaiser Nov. 1976 23 p refs Transl. into ENGLISH from Symp. Zerkleinern: Vortage und Diskussion des 1 Europaischen Symp. Zerkleinern, April 1962. Ed. Hans Rumpf, Dusseldorf, 1962 p 588-605
(BLL-RTS-10357) Avail: British Library Lending Div., Boston Spa, Engl.: £15.00; 14 BLL overseas, 15 European or 60 UK

BLL photocopy coupons

The classifier is described in principle as a zig-zag form, smooth inside and without any internal projections. A stream of air is blown through it from below upwards, as in a rising pipe pneumatic classifier. In spite of external appearances the classifier studied is a transverse flow rather than a rising flow air classifier. The movement of the load in the zig-zag tube is shown. Air velocity is adjusted so that the load or charge corresponds approximately so that the threshold size and average movement are neither upward nor downward. Only the movement of the material and the classification principle are illustrated. B.B.

N77-26421# Toronto Univ. (Ontario). Inst. for Aerospace Studies.

WAVE MOTION IN LOW-PRESSURE-RATIO RECTANGULAR AND PYRAMIDAL SHOCK TUBES

James Joseph Gottlieb Dec. 1975 75 p refs

(UTIAS-199; CN-ISSN-0082-5255) Avail: NTIS HC A04/MF A01

Closed-form solutions based on acoustic theory were obtained to describe the wave motion in both low-pressure-ratio rectangular (constant area) and pyramidal shock tubes which utilize different driver and channel gases. These new solutions are in excellent agreement with experimental data. Author

N77-26422# Sussex Univ., Brighton (England).

LIFT, CIRCULATION AND PRESSURE DISTRIBUTIONS FOR A FOIL OSCILLATING IN PITCHING MOTION IN A PERFECT FLUID

J. S. Turton and D. J. Peel 29 Jun. 1977 39 p refs Backup document for AIAA Synoptic "Constrained and unconstrained flow about a pitching foil", scheduled for publication in AIAA Journal, Oct. 1977

(UFD-1) Avail: NTIS HC A03/MF A01

A numerical method was developed for evaluating the circulation, profile pressure distribution, forces, and pitching moment of foils moving in the two dimensional flow of a perfect fluid. The particular case of quasi steady flow about a R.A.E. 104 profile oscillating in pitching motion about the quarter chord axis was studied. Amplitudes and phase angles of the circulation and lift ratios were obtained for incidence amplitudes of 10 deg, 3.2 deg, 7.7 deg about the zero mean over the reduced frequency range $0 < F$ 1.73. Effects of flow constraint from equidistant parallel walls on the amplitude and phase of the lift, computed by the image method for the incidence amplitude of 3.2 deg, are presented together with corresponding experimental results. Author

N77-26423*# Gulf South Research Inst., New Orleans, La. Polymer Development Dept.

WATER DIFFUSION MEMBRANES 3 (PERVAPORATION AND HEAT REJECTION THROUGH COMPOSITE MEMBRANES) Final Report

Israel Cabasso 1 Mar. 1977 65 p refs

(Contract NAS2-7650; GSRI Proj. 325-649-11)

(NASA-CR-151967) Avail: NTIS HC A04/MF A01 CSCL 20D

The problem of waste management in space is discussed for manned space flight. It is shown that such waste can be accounted for in one of four ways: (1) the waste may be dumped into space; (2) it may be accumulated for return to earth; (3) the waste may be separated into two fractions, one fraction (water) to be dumped into space and the remaining portion to be returned to earth; or (4) the waste components may be beneficially reused. M.C.F.

N77-26424# General Electric Co., Philadelphia, Pa.

THE INFLUENCE OF BOUNDARY POINT PROCEDURES ON ACCURACY AND EFFICIENCY IN FLOW FIELD CALCULATIONS

Darryl W. Hall Mar. 1977 34 p refs

(Doc-77SDR016) Avail: GE/Space and RESD Libraries, P.O. Box 8555, Philadelphia, Pa. 19191

A study is made of three computational boundary point procedures applied to three-dimensional inviscid supersonic steady flow calculations. The procedures are evaluated in terms of both accuracy and efficiency, and consideration is given to the physical significance of the inherent assumptions embodied in each of the schemes. A method of characteristics-type boundary point procedure is found to provide the best balance of accuracy and efficiency of the schemes examined. Author

N77-26425*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

VARIATIONAL ENERGY PRINCIPLE FOR COMPRESSIBLE, BAROCLINIC FLOW. 2: FREE-ENERGY FORM OF HAMILTON'S PRINCIPLE

Lawrence A. Schmid May 1977 109 p refs

(NASA-TM-X-71343; X-602-77-155) Avail: NTIS HC A06/MF A01 CSCL 20D

The first and second variations are calculated for the irreducible form of Hamilton's Principle that involves the minimum number of dependent variables necessary to describe the kinetmatics and thermodynamics of inviscid, compressible, baroclinic flow in a specified gravitational field. The form of the second variation shows that, in the neighborhood of a stationary point that corresponds to physically stable flow, the action integral is a complex saddle surface in parameter space. There exists a form of Hamilton's Principle for which a direct solution of a flow problem is possible. This second form is related to the first by a Friedrichs transformation of the thermodynamic variables. This introduces an extra dependent variable, but the first and second variations are shown to have direct physical significance, namely they are equal to the free energy of fluctuations about the equilibrium flow that satisfies the equations of motion. If this equilibrium flow is physically stable, and if a very weak second order integral constraint on the correlation between the fluctuations of otherwise independent variables is satisfied, then the second variation of the action integral for this free energy form of Hamilton's Principle is positive-definite, so the action integral is a minimum, and can serve as the basis for a direct trail and error solution. The second order integral constraint states that the unavailable energy must be maximum at equilibrium, i.e. the fluctuations must be so correlated as to produce a second order decrease in the total unavailable energy. Author

N77-26426# Toronto Univ. (Ontario). Inst. for Aerospace Studies.

AN EXPERIMENTAL INVESTIGATION OF THE DISTRIBUTION FUNCTION FOR THE NEAR FREE MOLECULAR PARALLEL PLATE HEAT TRANSFER PROBLEM

D. T. L. Tong Dec. 1976 122 p refs

(Grant AF-AFOSR-2091-71)

(UTIAS-210; CN-ISSN-0082-5255) Avail: NTIS HC A06/MF A01

Measurements of the molecular velocity distribution function between differentially heated parallel plates were obtained for Knudsen numbers in the transition flow range. The gas used was argon and the plate temperature ratio was 1.7. The specific distribution in terms of one velocity component, obtained by measuring the Doppler broadening of the 4609.6A All spectral line emitted as a result of excitation of the gas by an electron beam. Various plate spacing and pressure combinations were used to obtain Knudsen numbers between 0.07 and 3. The eight moment linearized model of Gross and Ziering provided the best overall representation of the date, with the four moment linearized model of Gross and Ziering and the biomodal solution of Lees predicting a substantially greater degree of asymetry in the distribution function than was observed at low Knudsen numbers. The good match between line data and the eight moment method indicates that the range of validity of linearzed solutions may be greater than would be expected based solely on the linearizing condition. Author

N77-26427# Army Cold Regions Research and Engineering Lab., Hanover, N. H.

APPLYING THE RECIPROCITY PRINCIPLE TO SOLVING HEAT CONDUCTIVITY PROBLEMS

A. I. Pekhovich Feb. 1977 20 p refs Transl. into ENGLISH from Izv. Vsesoyunznogo Nauchno- Issled. Skogo Instituta Gidrotekhniki Imeni B. Ye Vedenøyeva, USSR, v. 91, 1969 p 349-361

(AD-A037450; CRREL-TL-599) Avail: NTIS HC A02/MF A01 CSCL 20/13

It has been shown that the phenomenon of reciprocity which is known in physics also occurs in the case on non-established

heat propagation in a solid, specifically if the heat source is located at point 1 and at point 2 causes a temperature change delta t, then when the source is shifted to point 2 at point 1 there occurs the same change in temperature delta t. This makes it possible to obtain analytical solutions to some already known problems, as well as the new problems. The application of the reciprocity principle appears promising in summing up laboratory and full-scale studies. Author (GRA)

N77-26428# Army Cold Regions Research and Engineering Lab., Hanover, N. H.

APPLICATION OF THE EQUIVALENCY PRINCIPLE TO THE SOLUTION OF HEAT CONDUCTIVITY PROBLEMS

A. I. Pekhovich Feb. 1977 20 p refs Trans. into ENGLISH from Izv. Vsesoyuznogo Nauchno- Issled.'Skogo Instituta Gidrotekhniki Imeni V. Ye. Veneneyeva USSR, v. 92, 1970 p 125-137

(AD-A037584; CRREL-TL-597) Avail: NTIS HC A02/MF A01 CSCL 20/13

Several possibilities have been demonstrated for applying the equivalency principle to solving heat conductivity problems. In this process at the boundaries of a body the sources and resistances of one type are replaced by others in such a way that the dynamics of the body's temperature field remains unchanged. In particular it has been demonstrated that the solution of the problem of the temperature conditions in a semi-limited body covered with a layer of agitated fluid, in the presence of temperature resistance between the fluid and the body surface and in the presence of given heat flows from the outside and within the liquids, can be expressed as the sum of solutions for two problems with third-order boundary conditions at the surface of a body without fluid. Author (GRA)

N77-26429# Ballistic Research Labs., Aberdeen Proving Ground, Md.

CONTINUOUS SURFACE-DENSITY MONTE CARLO SOLUTION TO THE DIRICHLET HEAT-TRANSFER PROBLEM Final Report

Norman E. Banks and Thomas J. Hoffman Mar. 1977 31 p refs

(AD-A037899; BRL-1966) Avail: NTIS HC A03/MF A01 CSCL 20/13

In this report a new and efficient Monte Carlo approach to the solution of the Dirichlet problem is developed and implemented. This approach, the surface-density technique, is capable of treating problems with arbitrary geometric complexity. No compromises with the physics of the problem are required, and new insight into efficient Monte Carlo solutions of many difficult problems of mathematical physics is gained. The adaptability of Monte Carlo radiation transport codes to this method is highly useful for problems that require calculation of both heat transfer and radiation transport, e.g., analyses of fuel-shipping-casks. Criticality, shielding, and heat transfer can be calculated with one geometric description and one computer code.Author (GRA)

N77-26430# California Univ., Berkeley. Lawrence Berkeley Lab.

NUMERICAL METHODS IN HYDRODYNAMIC CALCULATIONS

W. F. Noh 8 Jun. 1976 84 p refs

(Contract W-7405-ENG-48)

(UCRL-52112) Avail: NTIS HC A05/MF A01

The elements of the theory of finite difference methods for the numerical solution of systems of partial differential equations, and in particular the equations of compressible fluid dynamics, are presented. The notions of numerical stability, consistency, order of accuracy, etc., of finite difference schemes are defined, and examples of each notion are given using both the linear heat equation and the linear wave equation. The integral or weak formulation of the hydrodynamic equations is derived, and from this the Rankine-Hugoniot jump conditions for shocks and the conditions that hold at contact discontinuities are formulated. The general theory of the viscosity method of von Neumann and Richtmyer for following shocks is derived, and the most common difference methods for the Lagrangian and the Eulerian representations are presented. A brief historical review of LLL's two-dimensional hydrodynamics codes is presented. ERA

N77-26431# Du Pont de Nemours (E. I.) and Co., Aiken, S.C.

NUMERICAL SIMULATION OF NATURAL CONVECTION IN CLOSED CONTAINERS USING A FULLY IMPLICIT METHOD

D. W. Pepper and S. D. Harris Nov. 1976 36 p refs Presented at Ann. Meeting of Am. Soc. Mech. Eng., New York, Nov. 1976

(Contract E(07-2)-1)

(DP-MS-75-127; Conf-761107-7) Avail: NTIS HC A03/MF A01

Numerical solutions have been obtained for two-dimensional free convective flow in rectangular and annular cavities using the strongly implicit procedure (SIP) and the cyclic reduction-fast Fourier transform(CR-FFT) technique. Rayleigh numbers range from 10,000 to 10 to the sixth power, Prandtl numbers from 0.713 to 1,000 radius ratios from 1 to 3 (annular cavities), and aspect ratios (height/width) from 1 to 15. Motion is generated by either uniformly heating the bottom wall or heating a vertical wall (nondimensional temperature of 1) and cooling the opposite wall (nondimensional temperature of 0). ERA

N77-26432# Aeronautical Research Associates of Princeton, Inc., N. J.

MODELING TWO-PHASE FLOW IN A SWIRL COMBUSTOR Technical Progress Report, 9 Oct. - 3 Dec. 1976

W. S. Lewellen, Harvey Segular, and Ashok K. Varma Dec. 1976 21 p refs

(Contract E(11-1)-4062)

(COO-4062-2) Avail: NTIS HC A02/MF A01

Progress made toward modeling two-phase flow in a swirl combustor is outlined particularly with regard to the development of a phenomenological model to guide proper scaling. This simple model will also serve as a skeleton for the more detailed computer model. Scaling relations indicate that the PERC design for the first stage gasifier-combustor for the CDIF should have a higher carbon conversion efficiency, but is likely to have a slightly higher ash carry/over than that which occurs in PERC's laboratory scale model. If desired, the carry/over may be reduced by decreasing the fraction of small coal particles. It also appears that the total pressure drop will be somewhat larger. ERA

N77-26433# California Univ., Livermore. Lawrence Livermore Lab.

PRELIMINARY ANALYSIS AND FEASIBILITY STUDY ON HIGH SPEED TURBULENCE GENERATOR

Alfred C. Buckingham 15 Oct. 1976 45 p refs

(Contract W-7405-eng-48)

(UCID-17291) Avail: NTIS HC A03/MF A01

Calculations and figures for preliminary design considerations on two high speed (1 to 20 m/s) turbulent flow generators are presented. The first is a modified wind tunnel using multiple turbulence screens and a downstream area contraction. The design provides a high quality and useful test length of almost homogeneous, quasi-isotropic turbulent flow. The second is a jet plate interrupted flow tube with a downstream area contraction. Predictions of pressure and total flow volume requirements for the Comte-Bellot and Bowand configurations are included as well as predictions of the lateral spreading rate and trajectory of the water droplets introduced into the turbulent core of tube aerosol stream. Detailed calculations on the flow uniformity, sidewall boundary layer effects, turbulence energy spectra, and spectral dissipation characteristics for each of the two configurations were reviewed. ERA

N77-26434# Sandia Labs., Livermore, Calif.

EQUILIBRIUM AND TRANSPORT ESTIMATES FOR HYDROGEN AND HELIUM VIA LENNARD-JONES FLUID

W. T. Ashurst Dec. 1976 306 p refs

(Contract E(29-1)-789)

(SAND-76-8710) Avail: NTIS HC A14/MF A01

The results of molecular dynamic transport calculations for the Lennard-Jones shear viscosity and thermal conductivity over a wide density and temperature range were succinctly expressed in terms of the excess coefficients (that part above the temperature dependent dilute gas value). These expressions reproduce within 2 percent the experimental viscosity data of H2 and D2 (to 2,000 Atm); and within 5 percent the experimental thermal conductivity of H2 (to 600 Atm) and He (to 1,200

Atm). The Lennard-Jones equations of state expressed as a density-temperature expansion for Helmholtz free energy, when combined with the hydrogen third virial coefficient reproduce hydrogen compressibility within 0.5 percent. These same expressions can also be used to estimate helium and hydrogen-helium compressibilities. FORTRAN program LJHEOS, which produces these estimates as a function of temperature and pressure (or density), was used to generate tables. ERA

N77-26435# Oak Ridge National Lab., Tenn. Computer Sciences Div.

ESTIMATING HEAT-TO-HEAT VARIATION FROM A STATISTICIAN'S POIN.' OF VIEW

Thomas L. Hebble 1976 32 p refs Presented at the Ann. Meeting of Am. Soc. of th' Mech. Engr., New York, 29 Nov. 1976

(Contract W-7405-eng-26)

(Conf-761107-5) Avail: NTIS HC A03/MF A01

Heat-to-heat variability is the change in results that occurs when the same tests under the same conditions are applied to samples from different heats of the same material. Heat-to-heat variability reflects, among other things, difference in chemistry and in processing history. Published Japanese tensile and creep tests on types 304 and 316 stainless steel tube are used to illustrate the analysis of variance technique as a tool for isolating heat-to-heat variation. The importance of the underlying model and the role of replication are indicated. Confidence intervals and tolerance limits are computed from numerical estimates of heat-to-heat variation. ERA

N77-26436# Dornier-System G.m.b.H., Friedrichshafen (West Germany).

DEVELOPMENT AND QUALIFICATION OF PCM THERMAL CAPACITORS. PART 1: DEVELOPMENT OF A 30 Wh PCM THERMAL CAPACITOR Final Report

Peter Blaser, Gerhard Hauser, and Rolf Strittmatter Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1976 118 p refs In GERMAN; ENGLISH summary 2 Vol.

(Contract BMFT-WRT-2073/01A0423)

(BMFT-FB-W-76-26-Vol-1) Avail: NTIS HC A06/MF A01; ZLDI, Munich DM 24,80

The development of a phase change material thermal capacitor having a latent heat capacity of 30 w-h is concerned with three different configurations, the design parameters of which were determined. Three engineering models were submitted to a series of thermal and mechanical tests performed with different power profiles, the operational temperature being 28 C. The thermal test results were compared with calculated values. The possibility of stabilizing the operational temperature within the given range or of damping occurring temperature peaks was demonstrated by functional tests performed in the power range between 15 and 60 W and at an angular position of 0 and 90 deg. Within an operational temperature range of 5 C, storage periods between 0.5 and 3 hrs were obtained. Author (ESA)

N77-26437# Dornier-System G.m.b.H., Friedrichshafen (West Germany).

DEVELOPMENT AND QUALIFICATION OF PCM THERMAL CAPACITORS. PART 2: DEVELOPMENT OF PCM THERMAL CAPACITOR PLATFORMS AND PCM THERMAL CAPACITOR RADIATORS Final Report

Peter Blaser, Gerhard Hauser, and Rolf Strittmatter Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1976 129 p In GERMAN; ENGLISH summary 2 Vol.

(Contract BMFT-WRT-2073/01A0423)

(BMFT-FB-W-76-27-Vol-2) Avail: NTIS HC A07/MF A01; ZLDI, Munich DM 27,10

Results of a development program which deals with theoretical and experimental investigations of phase change thermal capacitors for space application are described. Different types of thermal design with latent enthalpies between 120 and 380 w-h and an operational temperature of about 26 C were examined. The following frequent heat power profiles were considered: variable power, eclipse, and variable power combined with radiation. Besides filler structures previously qualified, a new thermal transport structure using heat pipes was investigated. Author (ESA)

N77-26438# Laboratoire d'Aerothermique du C.N.R.S., Meudon (France).

CALCULATION OF UNDEREXPANDED JETS ISSUING FROM SUPERSONIC NOZZLES [CALCULS DE JETS SOUS-DETENDUS ISSUS DE TUYERES SUPERSONIQUES]

J.-C. Lengrand Dec. 1975 127 p refs In FRENCH; ENGLISH summary Sponsored by CNES

(Rept-75-4; Publ-516) Avail: NTIS HC A07/MF A01

A semi-empirical model is proposed which describes the flow field of an underexpanded free jet issuing from a sonic or supersonic nozzle. It allows calculating the position of the jet boundary. While requiring moderate computation times, the model takes into account the influence of the nozzle boundary layer and may be applied, whether the external atmosphere is flowing or is at rest. It thus combines features that until now could not be found in a unique model. Original density and rotational temperature measurements in free jets are reported and compared with the predictions of the model. The different hypotheses are discussed, and the influence of various parameters is set in evidence. Due to the low density obtained in the experimental flow fields it appeared that problems related to vibrational and rotational relaxation and diffusion at the jet boundary should be discussed. Possible application of present results to satellite propulsion using hydrazine engines is also discussed. Author (ESA)

N77-26439# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.

A NUMERICAL MODEL TO EVALUATE THE BEHAVIOR OF A REGENERATIVE HEAT EXCHANGER AT HIGH TEMPERATURE

A. J. Geutjes Nov. 1976 46 p refs

(TH-76-E-66; ISBN-90-6144-0661) Avail: NTIS HC A03/MF A01

A mathematical model describing the heat transport in regenerative heat exchangers for an experimental MHD generator is presented. Solution of the set of equations by the method of successive overrelaxation results in the gas and material temperature along the height of the regenerator during the heating and cooling period is described. The temperature of the argon gas leaving the heater was also found. Calculations were made for heat exchangers filled with spheres and for heaters filled with cored bricks. In the first computations the inlet temperature and composition of the combustion gas were taken as constant. Axial heat conduction was assumed negligible. Radiative heat transfer from the combustion gas was included in the model. The results of the study are in qualitative agreement with experimental data. A quantitative comparison between this theory and experiments was hampered by lack of information regarding the burner settings during the heating period. Author (ESA)

N77-26440# Oxford Univ. (England). Dept. of Engineering Science.

WALL PRESSURE FLUCTUATIONS IN A BUBBLY FLOW Final Report

R. E. Franklin and J. McMillan Jun. 1976 58 p refs

(Contract AT/2057/049-ARL)

(OUEL-1157/76) Avail: NTIS HC A04/MF A01

A general review of the influence of gas bubbles on the pressure fluctuations in a liquid flow is presented, and an account is given of some experiments on the effects of air injection on the pressure fluctuations beneath a turbulent boundary layer in a quiet-running water tunnel of rectangular cross section. It was found that the effects are considerable near to and downstream of the point at which air is injected, but no evidence was found of radiated sound. Further work is proposed. Author (ESA)

N77-26441# Oxford Univ. (England). Dept. of Engineering Science.

ELECTRO-CHEMICAL MEASUREMENTS OF MASS TRANSFER IN SEMI-CYLINDRICAL HOLLOWS WITH LAMINAR FLOW IN A CHANNEL

J. K. Aggarwal 1976 26 p refs Sponsored by Sci. Res. Council

(OUEL-1175/76) Avail: NTIS HC A03/MF A01

Measurements are described of the circumferential distribution of mass transfer coefficient in a semi-cylindrical hollow mounted

transverse to the main flow in the base of a narrow rectangular channel in view of oxygenator development for artificial membrane lungs. Hydrodynamically fully-developed laminar flow existed at entry to the hollow. The experiments covered a Reynolds number range of about 20 to 500 whereas the hollow diameter varied from 4 to 12 mm. An electro-chemical technique, in which a redox couple comprised the electrolyte and thin nickel wires formed the test electrodes, was utilized. Current measurements, made under the diffusion-controlled electrolytic reaction, led to the evaluation of the Sherwood number. Author (ESA)

N77-26442# Oxford Univ. (England). Dept. of Engineering Science.

THE CALCULATION OF TWO PHASE PRESSURE DROP BY MEANS OF AN ANNULAR FLOW MODEL

B. J. Azzopardi and N. M. Williams (Atomic Energy Res. Estab., Harwell, Engl.) Nov. 1976 36 p refs

(OUEL-1181/77) Avail: NTIS HC A03/MF A01

Values of pressure drop calculated from an annular flow model were compared with experimental data. The predictions of other models were also examined. It is seen that the annular flow model usually slightly overpredicts and that the means and spreads of errors obtained from all the models used are similar. Although it overpredicts the cumulative pressure drop along the tube, the annular flow model predicts the correct trend. Changes in the initial conditions of the annular flow model were found to produce negligible effects except for certain limiting conditions. Author (ESA)

N77-26443# Bari Univ. (Italy). Ist. di Macchine.

COMPARISON BETWEEN POSSIBLE VARIANTS OF A PROGRAM USING AN UNSTEADY NUMERICAL SCHEME FOR CALCULATION OF THE FLOW IN A ONE-DIMENSIONAL NOZZLE [CONFRONTO FRA POSSIBILI VARIANTI DI UN PROGRAMMA CHE UTILIZZA UNO SCHEMA NUMERICO INSTAZIONARIO PER IL CALCOLO DEL FLUSSO IN UN UGELLO UNIDIMENSIONALE]

C. DeMichele Jun. 1976 48 p refs In ITALIAN; ENGLISH summary

Avail: NTIS HC A03/MF A01

A practical comparison is made between differenct possible versions of a calculation procedure based on the finite area approach for the time marching solution of Euler equations, using a computer program that solves the one-dimensional flow in a nozzle. This comparison was aimed at the selection of the method best suited to the development of a fully three-dimensional calculation of the inviscid flow in cascades, based on simple programming and low memory occupancy, with the same solution quality. Author (ESA)

N77-26444# Bari Univ. (Italy). Ist. di Macchine.

ANALYSIS OF AN UNSTEADY NUMERICAL SCHEME FOR CALCULATION OF TRANSONIC FLOW [ANALISI DI UNO SCHEMA NUMERICO INSTAZIONARIO PER IL CALCOLO DI FLUSSI TRANSONICI]

C. DeMichele Jun. 1976 82 p refs In ITALIAN; ENGLISH summary

Avail: NTIS HC A05/MF A01

The characteristics and capabilities of a calculation procedure based on the time marching solution of Euler equations proposed by Mc Donald are demonstrated. The mathematical analysis of different versions of the discretization scheme used are given. The work was aimed at the development of a quick two-dimensional calculation for transonic flows in cascades, this being the basis for a fully three-dimensional solution of the inviscid motion equations. Author (ESA)

N77-26445# European Space Agency, Paris (France).

A FINITE DIFFERENCE SCHEME FOR THE CALCULATION OF SUPERSONIC THREE DIMENSIONAL FLOW FIELDS AROUND BLUNT BODIES

Claus Welland May 1977 93 p refs Transl. into ENGLISH of 'Ein Differenzenverfahren zur Berechnung dreidimensionaler Stroemungsfelder um stumpfe Koerper in Ueberschall', DFVLR, Cologne Report DLR-FB-76-57, 10 Nov. 1976 Original report in GERMAN previously announced as N77-20034 Original German report available from DFVLR, Cologne DM 30,40

(ESA-TT-366; DLR-FB-76-57) Avail: NTIS HC A05/MF A01

An explicit-implicit finite difference scheme is given for the calculation of three-dimensional (3-D) inviscid flow fields around blunt bodies. This procedure should be applied essentially in the stagnation point domain, where subsonic and supersonic regions exist together. A detailed presentation is given of the complete necessary systems of equations, the needed coordinate transformation being discussed in detail. Subsequently the method of solution of the difference equations is described. In addition to fully 3-D axial symmetrical flow fields, 2-D were also calculated. The particularities of these flow fields are discussed briefly. Listing for 3-D and 2-D flow as well as a 3-D sample calculation conclude the paper. Author (ESA)

N77-26446# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.

STUDY OF NON-ISOENERGETIC TURBULENT JET MIXING IN A CONSTANT AREA DUCT

J. H. Blasenak and W. Tabakoff Sep. 1976 38 p refs

(Contract DAHC04-69-C-0016)

(AD-A033498; Rept-76-49) Avail: NTIS HC A03/MF A01 CSCL 20/4

A study of non-isoenergetic turbulent jet mixing between two streams has been conducted. Using a previously derived theoretical analysis for ducted mixing, an experimental investigation was performed to verify this theory and to determine the non-isoenergetic turbulent jet mixing characteristics in a constant area duct. Temperature profiles were measured at several axial locations in the duct for both a concentric and an eccentric configuration. It was determined that the theoretical and experimental temperature profiles agreed fairly well for both cases, although the concentric case showed better agreement than the eccentric case. It was also determined that a new constant of turbulence in the initial region was needed for non-isoenergetic mixing, mixing is generally more rapid than the theory predicted, the initial temperature difference between the two streams did not have much effect on the rate of mixing and a higher area ratio produced better agreement between the theory and the experimental data. It was concluded that the theory was good for a fairly simplified analysis. Author (GRA)

N77-26447# ARO, Inc., Arnold Air Force Station, Tenn.

AN APPLICATION OF THE CHAPMAN-KORST THEORY TO SUPERSONIC NOZZLE-AFTERBODY FLOWS Final Report, 1 Jul. 1975 - 30 Sep. 1976

R. C. Bauer and J. H. Fox AEDC Jan. 1977 58 p refs Sponsored by AF

(ARO Proj. R33P-G0A; ARO Proj. R33A-02A)

(AD-A035254; ARO-ETF-TR-76-121; AEDC-TR-76-158) Avail: NTIS HC A04/MF A01 CSCL 20/4

A Chapman-Korst-type analysis has been developed for estimating the bulk base flow properties of nozzle-afterbody configurations operating at supersonic speeds. The analysis includes the effects of both initial boundary layers, dissimilar thermodynamic properties of both streams, and a third base bleed gas. The inviscid portions of the jet and external flow are computed by the method of characteristics. The turbulent mixing analysis uses the turbulent kinetic energy method to determine the coefficient in a Prandtl-type eddy viscosity model. The empirical coefficients in the turbulent kinetic energy formulation are those developed for the turbulent mixing of jet flows. A new analytical model of the recompression process has been developed that eliminates the need for an empirical recompression factor to determine the stagnating streamline. The analysis is evaluated by comparing with experimental data for Mach 2.0 flow over a two-dimensional blunt base with hydrogen bleed, a two-dimensional backward-facing step and a hot and a cold rocket nozzle-afterbody configuration. Usually the theoretical base pressure is greater than experimental base pressure, indicating the mixing rate is too small. However, the recompression analysis predicts reasonable values of the recompression factor. Author (GRA)

N77-26448# Naval Intelligence Support Center, Washington, D. C.

TURBULENT WAKE IN A STRATIFIED MEDIUM

A. T. Onufriyev 25 Jan. 1977 8 p refs Transl. into ENGLISH from Prikl. Mekh. i Tekhn. Fiz. (USSR), no. 5, 1970 p 68-72

(AD-A036876; NISC-Trans-3877) Avail: NTIS

HC A02/MF A01 CSCL 20/4

The article discusses the problem of determining the shape of a turbulent wake formed behind a self-propelled body in a medium with a density variable in the direction of action of gravity. A schematic picture of the development of the wake behind the moving object is as follows: at the outset, the diffusion is the same in all directions, and the wake expands symmetrically; with increasing distance from the object, the diffusion becomes strongly anisotropic, it decreases in the vertical direction under the action of gravity, and the wake assumes a flattened shape; in the volume occupied by the wake, turbulent mixing within the wake gives rise to a more homogeneous density distribution than in the ambient medium; this volume of liquid is no longer in a state of equilibrium and, acted upon by gravity, tends to return to this state; the wake collapses, and this is accompanied by its further expansion in the horizontal direction and excitation of internal waves. GRA

N77-26449# Flow Research, Inc., Kent, Wash.
STABILITY AND TRANSITION IN BOUNDARY LAYERS ON REENTRY VEHICLE NOSETIPS Final Report, 16 Jul. 1975 - 15 Jul. 1976
Charles L. Merkle Jun. 1976 123 p refs
(Contract F44620-74-C-0049)
(AD-A035712; Flow-Res-71; AFOSR-76-1107TR) Avail: NTIS HC A06/MF A01 CSCL 20/4

The stability characteristics of the boundary layer on the nose tip of a reentry vehicle have been investigated for a wide range of conditions. Results based upon classical parallel-flow stability theory indicate that boundary layers on smooth-walled nose tips are stable by a wide margin at realistic Reynolds numbers. The addition of nonparallel effects, including the axisymmetric vortex stretching that is encountered as the boundary layer is swept over the nose tip, moves the neutral stability curve to lower Reynolds numbers, but by only negligible amounts, indicating that the parallel-flow analysis is more than adequate for the present problem. The stability results for rough-surface nosetips, which are based on a phenomenological model for the effects of roughness on the mean flow profiles, yield completely different conclusions. The presence of roughness can produce large, strongly unstable regions on the nosetip. In particular, the interaction between roughness and other parameters is especially important. The results indicate that in the presence of roughness, wall cooling is strongly destabilizing, whereas the effects of the pressure gradient are very weak. Both of these predictions are completely different from smooth-wall stability results but are in agreement with numerous experimental transition results. The calculations also indicate that surface mass addition is destabilizing in the presence of smooth walls but by much smaller amounts than indicated in the experiments of Demetriades, while it has very small effects in the presence of wall roughness. GRA

N77-26450# California Univ., La Jolla. Dept. of Applied Mechanics and Engineering Sciences.
FINE SCALE STRUCTURE OF TURBULENT VELOCITY FIELDS Final Report, 1 Feb. 1972 - 31 Oct. 1976
Frank H. Champagne Dec. 1976 20 p refs
(Grant AF-AFOSR-2287-72; AF Proj. 6813; AF Proj. 9781)
(AD-A035738; AFOSR-77-0032TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

An experimental investigation of three turbulent shear flows, a two-dimensional mixing layer, a high Reynolds number axisymmetric jet, and a cylinder wake, was completed. The measurements provide new information on the higher-order statistical characteristics of these flow fields and on the development of the mixing layer flow towards a self-preserving state. The relevance of initial conditions on the development of the mixing layer flow is considered in light of both present and previous data. An investigation of the validity of the Kolmogorov local similarity theories for the fine scale structure of turbulent velocity fields was undertaken. The importance of considering effects on spectra caused by deviations from Taylor's hypothesis in high intensity flows was demonstrated. Finally, an experimental study of the relaminarization of turbulent pipe flow subjected to a large decrease in Reynolds number was initiated. GRA

N77-26451# AiResearch Mfg. Co., Phoenix, Ariz.
RELIABILITY DATA FOR FLUIDIC SYSTEMS Final Engineering Report, 11 Apr. 1972 - 30 Jun. 1976
Wallis T. Fleming and Harry R. Gamble 7 Dec. 1976 94 p
(Contract DAAG39-72-C-0092)
(AD-A035724; AiResearch-76-411479; HDL-CR-76-092-1) Avail: NTIS HC A05/MF A01 CSCL 20/4

An investigation of fluidic technology has been conducted. The initial program activities involved collecting and documenting data from early experimental applications of AiResearch fluidic controls. An analysis of the failures experienced during laboratory and experimental testing revealed that the failure mode of greatest concern, fluidic circuit contamination, did not represent a serious obstacle to seeking operational applications for fluidic controls. Several production programs involving fluidic components were also studied and analyzed. These included the thrust reverser actuator on the General Electric CF6 engine for the McDonnell Douglas DC-10 airplane and for the European A.300B Airbus, the Lockheed S-3A ram air pressure regulators, the thrust reverser and secondary nozzle actuator for the BAC/Aerospatiale Concorde SST aircraft, and two pressure regulators on the Boeing E-3A AWACS aircraft. Of these applications, data from thrust reverser actuator on the General Electric CF6 engine for the McDonnell Douglas DC-10 aircraft greatly overshadowed the remainder of the information. At the time of preparation of this report, these data showed a fluidic module reliability in excess of 600,000 hours MTBF, based on over 5,425,000 component operating hours in normal airline usage. GRA

N77-26452# Naval Research Lab., Washington, D. C.
SOLUTION OF TRANSIENT PROBLEMS IN FREE SURFACE HYDRODYNAMICS Interim Report
J. P. Boris and M. J. Fritts (Science Applications, Inc., McLean, Va.) Feb. 1977 116 p refs
(RR0110941)
(AD-A037717; NRL-MR-3446) Avail: NTIS HC A06/MF A01 CSCL 20/4

Numerical algorithms for a Lagrangian treatment of incompressible hydrodynamics with free surfaces are developed and applied. The method centers about the use of a triangular, general-connectivity finite-difference mesh. The added flexibility arising from this triangular mesh permits accurate long-time solutions of complicated flows with shear and waves in free-surface problems. The techniques discussed here are applied to nonlinear free-surface waves and to unstable shear flow beneath a free surface in two dimensions. Author (GRA)

N77-26453# Tel-Aviv Univ. (Israel).
TRANSITION IN A BOUNDARY LAYER AND IN A PIPE FLOW Final Report, 1 Feb. 1972 - 28 Feb. 1977
Israel Wygnanski Feb. 1977 13 p refs
(Grant AF-AFOSR-2346-72; AF Proj. 9781)
(AD-A037664; AFOSR-77-0160TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

An experimental investigation was carried out in shear flows undergoing transition to turbulence and in fully developed turbulent flows. The aim of the experiment is to understand and control transition, as well as to determine the effects of transition on fully turbulent flows. In the boundary layer case this effect was clearly established at moderate Reynolds numbers. Author (GRA)

N77-26454# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Aeromechanics Div.
APPLICATION OF THE INITIAL PLUME ANGLE CORRELATION TO CORRECT NOZZLE/AFTBODY PRESSURE DRAG FOR HOT EXHAUST GAS EFFECTS Final Report, 1 Jan. - 1 Sep. 1976
Douglas L. Bowers Dec. 1976 83 p refs
(AD-A037471; AFFDL-TR-76-138) Avail: NTIS HC A05/MF A01 CSCL 20/4

This report discusses the use of the initial plume angle correlation to correct cold exhaust jet nozzle/aftbody pressure drag for hot exhaust jet effects. Examining a broad base of data, the initial plume angle correlation proved effective in accounting for exhaust gas temperature effects for moderate temperature increases and high nozzle pressure ratios. The correlation was not effective for low nozzle pressure ratios and for nozzle configurations which have highly separated external flow. Also included are descriptions and results from other sources of hot exhaust jet data relating to ratio of specific heat effects,

temperature effect on exhaust plume spreading, and the effect of body heating on external nozzle boattail performance.
Author (GRA)

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N77-26455 British Library Lending Div., Boston Spa (England).
A TEST OF THE USE OF THERMISTOR SENSORS FOR MEASURING SMALL RATES OF WATER FLOW
J. Majewski Jan. 1977 18 p refs Transl. into ENGLISH from Rozprawy Hydrotechniczne (Danzig), v. 14, 1963 p 119-131
(BLL-RTS-10421) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

Measurements of water flow rates in hydraulic systems are studied. Low rates in the laboratory and in field measurements are listed as follows: (1) velocity measurements in laboratory trails; (2) velocity measurements of water or effluents abstracted to low lying rivers, lakes and nonflowing canals; (3) measurements of deep sea currents; and (4) leakage measurements past the seals of water reservoirs, such as hydraulic power stations, flood control reservoirs, etc. Author

N77-26456*# Southwest Research Inst., San Antonio, Tex.
SURVEY AND EXPERIMENTAL TESTING OF NONGRAVIMETRIC MASS MEASUREMENT DEVICES Final Report
William E. Oakey and Richard Lorenz Jun. 1977 57 p
(Contract NAS9-14941; SwRI Proj. 16-4498)
(NASA-CR-151427) Avail: NTIS HC A04/MF A01 CSCL 14B

Documentation presented describes the design, testing, and evaluation of an accelerated gravimetric balance, a low mass air bearing oscillator of the spring-mass type, and a centrigufal device for liquid mass measurement. A direct mass readout method was developed to replace the oscillation period readout method which required manual calculations to determine mass. A protoype 25 gram capacity micro mass measurement device was developed and tested. Author

N77-26457*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GSFC SHORT PULSE RADAR, JONSWAP-75
D. M. LeVine, W. T. Walton, J. Eckerman, R. L. Kutz, M. Dombrowski, and J. E. Kalshoven, Jr. Jun. 1977 45 p refs
(NASA-TN-D-8502; G-7702-F11) Avail: NTIS HC A03/MF A01 CSCL 17I

In September 1975, the Goddard Space Flight Center operated a short pulse radar during ocean wave measuring experiments off the coast of West Germany in the North Sea. The experiment was part of JONSWAP-75. The radar system and operations during the experiment are described along with examples of data. Author

N77-26458*# Morgan State Coll., Baltimore, Md.
THE CALIBRATION OF PHOTOGRAPHIC AND SPECTROGRAPHIC FILMS
Ernest C. Hammond, Jr. 30 Sep. 1976 11 p ref
(Grant NsG-5074)
(NASA-CR-152525) Avail: NTIS HC A02/MF A01 CSCL 14E

Certain techniques and procedures are developed and evaluated for the ascertainment of the relative spectral-photometric characteristics of standard and special spectroscopic films and plates in the visible and UV regions. These films are used in ground based and rocket launched instruments. Two photographic spectral sensitometers were developed. One instrument is a vacuum sensitometer covering a range of 1,000 to 3,000 Angstroms and the other sensitometer is the device this investigator used to study its spectral responses in the visible region of the spectrum through the utilization of a computer microdensitometric and photometric plot and contour routines.
Author

N77-26459# Stanford Research Inst., Menlo Park, Calif.
STRESS-GAGE SYSTEM FOR THE MEGABAR (100GPA) RANGE
P. S. DeCarli, D. C. Erlich, L. B. Hall, Rob Bly, and Art Whitson Jun. 1976 80 p refs
(Contract DNA001-75-C-0029)
(AD-A035583; DNA-4066F) Avail: NTIS HC A05/MF A01 CSCL 14/2

The useful range of the manganin piezoresistive stress transducer was extended from the former limit of about 45 GPa (450 kbar) to about 125 GPa (1,250 kbar). The major problem encountered was shunting of the gage, caused by the increased electrical conductivity of insulators at high shock stresses. The effect of shunting was minimized through use of very-low-impedance (0.05 to 0.15-ohm) gages and through careful attenuation to gage geometry. Loading and release calibration data for manganin were obtained over the stress range between about 25 and about 125 GPa. The results of earlier work, calibrating to 45 GPa, are critically reviewed. All of the reliable data on the dynamic piezoresistance of manganin can be fitted by the piecewise calibration curve. A prototype high-stress mutual-inductance particle velocity gage was designed and tested. Six manganin gages, one background (unpowered manganin) gage, and one aluminum preheat temperature gage were fielded in the Debris Coupling Experiment of the Husky Pup nuclear event. Despite power supply failure, attributed to preshot flooding of the instrumentation alcove, excellent time-of-arrival data were obtained. These data disagree by about a factor of two with preshot predictions of shock-wave propagation in the Debris Coupling Experiment. GRA

N77-26460# Sandia Labs., Albuquerque, N. Mex.
VISAR MEASUREMENTS OF VELOCITIES IN EXPLOSIVE VALVES
R. Ng Dec. 1976 33 p refs
(Contract E(29-1)-789)
(SAND-76-8048) Avail: NTIS HC A03/MF A01

A Velocity Interferometer System for Any Reflector (VISAR) was used to measure the velocity histories of plungers in explosively actuated valves. These experiments proved the capability of measuring valve interactions by means of a VISAR and provided empirical information and data for analytical studies. ERA

N77-26461# California Univ., Livermore. Lawrence Livermore Lab.
CLINICAL HIGH-PURITY GERMANIUM GAMMA-CAMERA
J. H. Ewins, G. A. Armantrout, D. C. Camp, L. Kaufman (Calif. Univ., San Francisco), R. S. Hattner (Calif. Univ., San Francisco), D. C. Price (Calif. Univ., San Francisco), V. S. Lorenz (Calif. Univ., San Francisco), K. E. Hosier (Lawrence Berkeley Lab., Berkeley), and K. L. Lee (Lawrence Berkeley Lab., Berkeley) 4 Oct. 1976 14 p refs Presented at the IAEA Symp. on Medical Radionuclide Imaging, Los Angeles, 25-29 Oct. 1976
(Contract W-7405-eng-48; GM-70598)
(UCRL-78132; Conf-761060-1) Avail: NTIS HC A02/MF A01

A 3,072-element, high purity germanium camera with a 2-mm spatial resolution, an energy resolution of 2 to 3 percent for/sup 99m/Tc, and a clinically useful area of 123 sq cm for imaging the average adult heart, breast or brain is being developed. To this end a 100-element prototype was constructed and images of rats and mice were obtained with the use of single and multiple isotopes. A second prototype with 512 elements was also completed and tested. The 512 elements are derived from an array of electrodes, on the bottom of two germanium crystals, orthogonal to 16 electrodes on the top. The top electrodes are electrically in parallel and have a common electronic readout. The p-contact is palladium over germanium oxide, and the n-side is gold over the lithium diffusion. Cooling for the detector is accomplished through a sapphire motherboard by way of indium

contacts which are also the electrical contacts for the n-side. The isolation between the strips on the p-and the n-sides is adequate to attain good energy resolution. ERA

N77-26462# California Univ., Livermore. Lawrence Livermore Lab.

MICROSECOND HOLOGRAPHIC INTERFEROMETER FOR FRACTURE STUDIES

W. H. Gust 26 Oct. 1976 23 p refs
(Contract W-7405-eng-48)
(UCRL-52161) Avail: NTIS HC A02/MF A01

A detailed description of the operation of each component that makes up a double-pulsed, ruby-laser, holographic interferometer is presented. Some results obtained from the dynamic measurement of three-dimensional surface deformation related to fracture initiation and propagation in 6061 aluminum are reported. ERA

N77-26463# Edgerton, Germeshausen and Grier, Inc., Santa Barbara, Calif.

LOW BACKGROUND Ge(Li) DETECTOR WITH ANTICOINCIDENCE NaI ANNULUS (REVISED)

W. Quam, J. Houk, and R. Mohr Feb. 1976 37 p
(Contract EY-76-C-08-1183)
(EGG-1183-2326-Rev) Avail: NTIS HC A03/MF A01

A low background gamma-ray counter intended for the assessment of environmental soil and vegetation samples is described. It can accept samples up to 350 grams and 225 cu cm volume. The primary intent of this counter is the determination of U, Th, K-40 and Cs-137 in soil samples obtained routinely during ARMS surveys throughout the country. To this end, careful calibrations traceable to the ERDA New Brunswick Laboratory and to the NBS have been made. Special attention was paid to volume source techniques in addition to the usual point source methods. Detectabilities (at 3 sigma), all in a 350-gram sample, are 0.03 ppm uranium, 0.09 ppm thorium, 30 pCi of potassium-40, and 3 pCi of cesium-137. ERA

N77-26464# Los Alamos Scientific Lab., N. Mex.

DIGITAL RECONSTRUCTION OF A CODED IMAGE OBTAINED WITH A NONREDUNDANT PINHOLE ARRAY

K. S. Han, G. J. Berzins, D. S. Mason (EG and G, Los Alamos, N. Mex.), and D. G. Langner (EG and G., Los Alamos, N. Mex.) 1976 12 p refs Presented at the IEEE Intern. Pulsed Power Conf., Lubbock, Tex., 9 Nov. 1976
(Contract W-7405-eng-36)
(LA-UR-76-1789; Conf-761106-8) Avail: NTIS HC A02/MF A01

A coded image or pseudohologram, obtained optically with a nonredundant pinhole array imaging aperture was digitized in a 512 x 512 format. Images were reconstructed digitally. The reconstruction scheme, a deconvolution in the Fourier domain, is presented. The applicability of the technique to a real time imaging system is discussed. ERA

N77-26465# California Univ., Berkeley. Lawrence Berkeley Lab.

INSTRUMENTATION MAINTENANCE

Dick A. Mack Sep. 1976 26 p refs Presented at the Conf. on Management of Lab. Instr., Cairo, 5-14 Nov. 1976
(Contract W-7405-eng-48)
(LBL-5505; Conf-761105-4) Avail: NTIS HC A03/MF A01

The organization, staffing and operation of a facility for instrument repair is described. Maintenance policy should be based on studies of (1) preventive vs. catastrophic maintenance, (2) records indicating when equipment should be replaced rather than repaired and (3) priorities established to indicate the order in which equipment should be repaired. Upon establishing a workable maintenance policy, the staff should be instructed so that they may provide appropriate scheduled preventive maintenance, calibration and corrective procedures, and emergency repairs. The education, training and experience of the maintenance staff are discussed along with the organization for an efficient operation. The layout of the various repair shops is described in the light of laboratory space and financial constraints. ERA

N77-26466# California Univ., Berkeley. Lawrence Berkeley Lab.

INSTRUMENTATION CALIBRATION

Dick A. Mack Aug. 1976 40 p refs Presented at the Conf. on the Management of Lab. Instr., Cairo, 5 Nov. 1976
(Contract W-7405-eng-48)
(LBL-5506; Conf-761105-1) Avail: NTIS HC A03/MF A01

Procedures for the calibration of different types of laboratory equipment are described. Provisions for maintaining the integrity of reference and working standards traceable back to a national standard are discussed. Methods of validation and certification methods are included. An appendix lists available publications and services of national standardizing agencies. ERA

N77-26467# Sandia Labs., Albuquerque, N. Mex. Facilities/Test Equipment Design and Development Div.

CALCULATOR CONTROLLED STRAIN GAGE DATA ACQUISITION SYSTEM

Malcolm H. Woodward Oct. 1976 54 p refs
(Contract E(29-1)-789)
(SAND-76-0146) Avail: NTIS HC A04/MF A01

The system described provides online automated data acquisition for strain gages. Test initialization and setup time is significantly decreased. Neither zero balance, span adjust, nor calibrate resistor switching in and out is necessary. These four functions are saved per channel on a possible 100 channels. When the system is not being used for test control, the calculator can be used to perform mathematical calculations. The use of the keyboard is easily learned, and test personnel do not need to familiarize themselves with a programming language in order to use the system. ERA

N77-26468# Sandia Labs., Albuquerque, N. Mex.

ACOUSTICAL HIGH SPEED HOLOGRAPHIC FRAMING CAMERA

M. J. Landry and W. K. Ream 1976 11 p refs Presented at the Electro-Optics Laser Conf. and Exposition, New York, 14 Sep. 1976
(Contract AT(29-1)-789)
(SAND-76-5886; Conf-760961-8) Avail: NTIS HC A02/MF A01

In recording holographic interferograms of transient events, several techniques were used to accomplish multiple time framing. These include using multiple lasers, beam splitting and multiple unequal optical delaying of a single laser beam; multiple cameras in conjunction with real time holographic interferograms, or a multiple cavity laser (MCL) holographic system with an independent operating cavity for each frame. Another technique, which would use a multiple cavity laser system in conjunction with a high speed acoustical deflector for making holograms, is described. This technique would have all the advantages of the MCL holographic system which allows more energy to be delivered to the object than does beam splitting, provides a reduction in instrumentation cost compared to multiple lasers, allows more flexible timing and a longer time interval between frames than do beam splitting or multiple cameras, and has better resolution than multiple cameras. ERA

N77-26469# Cessna Aircraft Co., Wichita, Kans. Wallace Div.

A-37B FATIGUE SENSOR DATA ANALYSIS METHODOLOGY PROGRAM Final Report, Aug. 1974 - Oct. 1975

John Y. Kaufman Wright-Patterson AFB, Ohio ASD Feb. 1976 65 p refs
(Contract F33657-71-C-0163)
(AD-A037341; Rept-318E-7616-061/; ASD-TR-75-42) Avail: NTIS HC A04/MF A01 CSCL 01/3

A feasibility study was conducted on two methods of fatigue sensor data analysis. The first method constructs an equivalent straight line strain exceedance history from sensor data. The second method converts sensor data directly to fatigue damage. A technique is discussed for the effect of mean strain. Both methods are shown to be feasible. Author (GRA)

N77-26470# Systems Research Labs., Inc., Dayton, Ohio.

A THERMAL IMAGING SENSOR EVALUATION FACILITY Interim report, Jan. - Jun. 1976

Donald V. Campbell, Jr., Jeffrey P. Johnson, and William R. Mallory Jan. 1977 98 p refs
(Contract F33615-73-C-1135; AF Proj. 2004)

(AD-A037411; AFAL-TR-76-223) Avail: NTIS HC A05/MF A01 CSCL 17/5

A facility has been developed for testing and evaluating thermal imaging sensors. The facility employs a differential temperature source imaged by a 12 inch off-axis parabolic mirror collimator. The facility can provide differential temperatures ranging from -20C to +80C. Four-bar resolution targets are available from 0.25 cy/mrad to 9.0 cy/mrad. Tests that can be performed include minimum resolvable temperature difference (MRT), signal transfer function (SiTF), modulation transfer function (MTF) and line spread function (LSF), uniformity, and distortion. Author (GRA)

N77-26471# Naval Avionics Facility, Indianapolis, Ind.
DEVELOPMENT OF SANDWICH STRUCTURED PHOTOSENSITIVE FILMS FOR APPLICATION TO NON-CONTACT POTENTIOMETERS
Gary A. Magee Nov. 1976 54 p refs
(AD-A037412; NAFI-TR-2148-Rev-1) Avail: NTIS HC A04/MF A01 CSCL 14/2

This report discusses methods of fabrication for a sandwich structured photoconductor. Test results from various cells are presented. The development of a thin film phototransistor is discussed. Author (GRA)

N77-26472# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
SATURATION, HEU, AND NORMALIZED COLOR: CALCULATION, DIGITIZATION EFFECTS, AND USE Interim Report
John R. Kender Nov. 1976 57 p refs
(Contract F44620-73-C-0074; AF Proj. 2304)
(AD-A037772; AFOSR-77-0328TR) Avail: NTIS HC A04/MF A01 CSCL 14/2

Three transformations used in the analysis of tricolor natural scenes are analyzed. All have nonremovable singularities, near which they are highly unstable. Given digital input, the distribution of their transformed balues is highly nonuniform, characterized by spurious modes and gaps. These effects are quantified and illustrated. In addition, a significantly faster algorithm for hue is derived. Image segmentation techniques of edge detection, region growing cluster, and region splitting are affected arbitrarily badly by such problems. Some stratagems are illustrated that help minimize the bad behavior. Linear transformations are presented as a generally favorable alternative to these three nonlinear ones. Author (GRA)

N77-26473# Philips Labs., Briarcliff Manor, New York.
DEVELOPMENT OF AN OPTICAL DISC RECORDER Quarterly Technical Report, 1 Oct. - 31 Dec. 1976
George Kenney, F. Zernike, D. Lou, Robert Harper, and M. Giebler Feb. 1977 72 p refs
(Contract N00014-76-C-0441; ARPA Order 3080)
(AD-A037832) Avail: NTIS HC A04/MF A01 CSCL 14/3

Several air sandwich discs were fabricated and recordings made with them. Tellurium was chosen as the best material of those considered. Studies show that tellurium films are twice as sensitive as bismuth films and are quite resistant to high-temperature degradations. Micron-size pits were recorded in a tellurium film at 2 Mbits/sec with a 25mW He-Ne laser. Extensive tests and evaluations of focus motors and the air bearing sled indicate that an acceptable focus motor and sled can now be integrated into the recorder. Two types of air bearing turntables are now available, including one assembled from standard U.S. manufactured parts. A Miller modulator/demodulator of digital information was designed, built and successfully tested. A study and computer simulation of the modulator/demodulator is presented. GRA

N77-26474# Defence Research Establishment Pacific, Victoria (British Columbia).
THE APPLICATION OF A CURVED GRAPHITE CRYSTAL MONOCHROMATOR TO X-RAY DIFFRACTOMETRY
K. I. McRae and C. A. Waggoner Dec. 1976 21 p refs
(AD-A037952; DREP-TM-76-12) Avail: NTIS HC A02/MF A03 CSCL 14/2

The design, function and application of a curved crystal graphite monochromator in X-ray diffractometry are reviewed. By further diffraction of the primary diffracted X-ray beam, the crystal removes unwanted radiation, including K-beta and other target lines and fluorescent or scattered radiation from the sample, with the result that signal-to-background ratios are significantly improved. Recorder scans and signal-to-noise data are presented for a variety of chemical compounds, including an ash deposit from a ship's boiler, to illustrate the effectiveness of the monochromator in the analytical application of X-ray diffractometry. Author (GRA)

N77-26475# Air Force Weapons Lab., Kirtland AFB, N.Mex.
THERMAL RADIATIVE LOSSES FROM GRAPHITE CALORIMETERS USED IN PULSED ELECTRON BEAM EXPERIMENTS Final Report
John A. MacFarlane Nov. 1976 50 p refs Sponsored by Defense Nuclear Agency
(AD-A037754; AFWL-TR-76-180) Avail: NTIS HC A03/MF A01 CSCL 20/13

A study to analytically model the thermal behavior of a graphite calorimeter block subjected to an initially non-uniform temperature profile has been conducted. The model allows prediction of the amount of energy lost from the block by the time a uniform temperature profile is achieved. It is assumed that the only means of energy loss to the surroundings is that of thermal radiation; the effects of convection and thermal conduction to the surroundings are neglected. In addition, it is assumed that the calorimeter is exposed to a uniform beam of energy with an area equal to that of the calorimeter face. Thus, conduction in the lateral directions is neglected. Finally, it is assumed that the beam energy is deposited instantaneously, with the resultant temperature profile being taken as an initial condition. The results of a parametric study in which the radiation losses are quantified for a variety of electron beam environments are presented. Finally, an evaluation of the manner in which calorimetry data are presently reduced is made. Author (GRA)

N77-26476# Virginia Univ., Charlottesville. Dept. of Physics.
CRYOGENIC INSTRUMENTATION Final Technical Report, 15 Jun. 1969 - 14 Dec. 1974
J. W. Beams, R. V. Coleman, B. S. Deaver, Jr., A. S. DeReggi, and G. B. Hess 15 Mar. 1977 33 p refs
(Contract N00014-69-A-0429)
(AD-A037133) Avail: NTIS HC A03/MF A01 CSCL 20/12

For the period June 15, 1969 through December 14, 1974, research on Cryogenic Instrumentation was carried out at the University of Virginia as part of project Themis. The emphasis of the program was on experimental and theoretical study of various low temperature phenomena that have device applications, particularly superconducting devices and materials. Accomplishments are reported on the following topics: Tunneling, Conduction and Magnetic Phenomena, Superconductivity in Transition Metals and Transition Metal Compounds, Device Applications of Weak Links, Fluxoid Quantization and Flux Flow, Fundamental Fluctuation Measurements in Superconductor Microchannels, Applications of High Q Superconducting Cavities, Properties of Liquid Helium, and Low Temperature Centrifugation. Short summaries of the work are given together with lists of publications which report the details. Author (GRA)

36 LASERS AND MASERS

Includes parametric amplifiers.

N77-26477* National Aeronautics and Space Administration. Pasadena Office, Calif.
ISOTOPE SEPARATION USING METALLIC VAPOR LASERS Patent
Gary R. Russell (JPL), Che Jen Chen (JPL), and Kenneth G. Harstad, inventors (to NASA) (JPL) Issued 21 Jun. 1977 9 p Filed 26 Jun. 1974 Sponsored by NASA
(NASA-Case-NPO-13550-1; US-Patent-4,031,389; US-Patent-Appl-SN-483301; US-Patent-Class-250-283; US-Patent-Class-250-281; US-Patent-Class-250-282; US-Patent-Class-250-423P) Avail: US Patent Office CSCL 20E

The isotope U235 is separated from a gasified isotope mixture

of U235 and U238 by selectively exciting the former from the ground state utilizing resonant absorption of radiation from precisely tuned lasers. The excited isotope is then selectively ionized by electron bombardment. It then is separated from the remaining isotope mixture by electromagnetic separation.
Official Gazette of the U.S. Patent Office

N77-26478*# Schafer (W. J.) Associates, Inc., Arlington, Va.
INVESTIGATION OF POSSIBILITIES FOR SOLAR POWERED HIGH ENERGY LASERS IN SPACE Final Report
John D. G. Rather, Edward T. Gerry, and Glen W. Zeiders 25 May 1977 48 p refs
(Contract NASw-3048)
(NASA-CR-153271; Rept-77SR-VA-U3) Avail: NTIS HC A03/MF A01 CSCL 20E

The feasibility of solar powered high energy lasers in space has been studied. Preliminary analysis indicates that both direct and indirect pumping methods lead to high energy lasers having interesting efficiencies and capabilities. Many topics for further research have been identified. Author

N77-26479*# Vanderbilt Univ., Nashville, Tenn. Dept. of Physics and Astronomy.
NUCLEAR PUMPED LASER II Final Contractor Report, Aug. 1975 - Aug. 1977
Russell J. DeYoung, Ja. H. Lee, and W. T. Pinkston Aug. 1977 39 p refs
(Grant NsG-1232)
(NASA-CR-153292; VU-PL-7/77) Avail: NTIS HC A03/MF A01 CSCL 20E

The first direct nuclear pumped laser using the He-2-(n,p) H-3 reaction is reported. Lasing took place on the 1.79 microns Ar I transition in a mixture of He-3-Ar at approximately 600 Torr total pressure. It was found that the electrically pulsed afterglow He-Ar laser had the same concentration profile as the nuclear pumped laser. As a result, nuclear lasing was also achieved in He-3-Xe (2.027 micron) and He-3-Kr (2.52 micron). Scaling of laser output with both thermal flux and total pressure as well as minority concentration has been completed. A peak output (He-3-Ar) of 3.7 watts has been achieved at a total pressure of 4 atm. Direct nuclear pumping of He-3-Ne has also been achieved. Nuclear pumping of a He-3-NF3 mixture was attempted, lasing in FI at approximately 7000 A, without success, although the potential lasing transitions appeared in spontaneous emission. Both NF3 and 238UF6 appear to quench spontaneous emission when they constitute more than 1% of the gas mixture. Author

N77-26480*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANALYSIS OF LASER FLUOROSENSOR SYSTEMS FOR REMOTE ALGAE DETECTION AND QUANTIFICATION
Edward V. Browell Washington Jun. 1977 41 p refs
(NASA-TN-D-8447; L-11007) Avail: NTIS HC A03/MF A01 CSCL 20E

The development and performance of single- and multiple-wavelength laser fluorosensor systems for use in the remote detection and quantification of algae are discussed. The appropriate equation for the fluorescence power received by a laser fluorosensor system is derived in detail. Experimental development of a single wavelength system and a four wavelength system, which selectively excites the algae contained in the four primary algal color groups, is reviewed, and test results are presented. A comprehensive error analysis is reported which evaluates the uncertainty in the remote determination of the chlorophyll a concentration contained in algae by single- and multiple-wavelength laser fluorosensor systems. Results of the error analysis indicate that the remote quantification of chlorophyll a by a laser fluorosensor system requires optimum excitation wavelength(s), remote measurement of marine attenuation coefficients, and supplemental instrumentation to reduce uncertainties in the algal fluorescence cross sections. Author

N77-26481# Mathematical Sciences Northwest, Inc., Bellevue, Wash.
ELECTRICALLY INITIATED HCl CHEMICAL LASER AND THRESHOLD EXCITATION OF XeF AND KrF LASERS Final Report, 15 Jul. 1974 - 30 Sep. 1976
L. Y. Nelson, A. L. Pindroh, C. H. Fisher, S. R. Byron, and R. E. Center Feb. 1977 88 p refs
(Contract N00014-75-C-0052; ARPA Order 1807)
(AD-A037732; MSNW-77-1049-1) Avail: NTIS HC A05/MF A01 CSCL 20/5

The electrical excitation of the HCl chemical laser by the vibrational enhancement of the reaction Cl + H2(v=1) HCl(v=v,1) + H is reported. Detailed kinetic modelling of the e-beam and e-beam sustained discharge experiments was used in the interpretation of the experimental data. The rate constant for the vibrationally enhanced reaction was 40 times larger than for the reaction with H2(v=0) at T = 300 K. The maximum electrical to laser conversion efficiency obtained was 3 percent. The second part of the report describes measurements of the threshold pumping power density in e-beam sustained discharge excitation of KrF and XeF lasers. Stable discharges were obtained in Ar-Kr-F2 and Ar-Xe-NF3 mixtures at 1 atm for times greater than 0.5 microsecond and lasing pulse width as long as 0.5 microsecond. The threshold pump power densities varied inversely with the cavity build up time. Based on the present results it is evident that efficient laser operation in KrF and XeF could be achieved in a 1-m long sustained discharge with input power densities in the range of 50 to 100 kW/cu cm over a 1 microsecond time scale. GRA

N77-26482# Sandia Labs., Albuquerque, N. Mex. Laser Development Div.
PICOSECOND AND NANOSECOND Nd: GLASS HIGH POWER LASER AMPLIFIER SYSTEM
John P. Anthes, John W. Lavasek, and Merrill A. Palmer Sep. 1976 51 p refs
(Contract E(29-1)-789)
(SAND-76-0432) Avail: NTIS HC A04/MF A01

The beam characteristics and operating parameters of a high-power Nd(3+): glass laser at Sandia Laboratories were defined. The temporal and spatial nature of the laser pulse was examined at a variety of different pulse lengths, including 50 psec, 100 psec, 200 psec, and 10 nsec, with total laser power up to 40 GW. The determination of optimal operational parameters was essential for the interpretation of laser-matter interaction experiments being done at Sandia Laboratories. ERA

N77-26483# Johns Hopkins Univ., Baltimore, Md. Dept. of Chemistry.
FAR INFRARED CHEMICAL LASERS Technical Progress Report, 1 Aug. 1975 - 31 Jul. 1976
Dean W. Robinson Aug. 1976 32 p refs
(Contract E(11-1)-2523)
(COO-2523-8; TPQ-2) Avail: NTIS HC A03/MF A01

A pumping mechanism was found for the CO2 gas laser which involves the transfer of electronic energy from O2 to CO2, the oxygen dropping to the DELTA g state. This appears to pump vibrational states of CO2 which are above the lasing state, and which most deactivate collisionally to before the emission pulse. A pure rotational, diatonic OH laser was discovered which is collisionally pumped from excited vibrational levels. Typical pure rotational lasing is observed between J levels energetically equivalent to the vibrational frequency. These outputs were compared for different rare gas collisonal partners and it was found that the intensity passes through a maximum for partners of intermediate mass, Ne or Ar. ERA

N77-26484# California Univ., Livermore. Lawrence Livermore Lab.
APPLICATION AND PERFORMANCE OF RARE GAS OXIDE AMPLIFIERS
H. T. Powell, J. R. Murray, L. G. Schlitt, and J. Taska Aug. 1976 9 p refs Presented at 3d Colloq. on Elec. Transition Lasers, Aspen, Colo., 7-10 Sep. 1976
(Contract W-7405-eng-48)
(UCRL-78483; Conf-760949-5) Avail: NTIS HC A02/MF A01

Rare gas oxides (RGO) are being investigated as possible gain media for scalable fusion lasers. Typcial mixtures using electronbeam excitation are 12 atm Xe or 25 atm Kr plus a few Torr of O2. The O('s) production was studied as a function of current density over the range 30 to 1,000 A/square cm using a 50 nsec pulse. At these operating pressures the O('s) production saturates for currents greater than 100 A/square cm.

The RGO fluorescence intensity variations across the aperture were compared with the energy deposition calculated by a three-dimensional Monte Carlo code (SANDYL) and found to be in excellent agreement. Gain measurements were made using a CW dye laser operating at 0.01 nm linewidth. ERA

N77-26485# California Univ., Livermore. Lawrence Livermore Lab.
FOUR-D PROPAGATION CODE FOR HIGH-ENERGY LASER BEAMS: A USER'S MANUAL
J. R. Morris 5 Aug. 1976 92 p refs Sponsored in part by Navy and Army
(Contract W-7405-eng-48)
(UCID-17217) Avail: NTIS HC A05/MF A01

The use and structure of the June 30, 1976 version of the Four-D propagation code for high energy laser beams are described. Selected sample output from a typical run and from several debug runs are provided. The Four-D code now includes the important noncoplanar scenario feature. Many problems that required excessive computer time can now be meaningfully simulated as steady-state noncoplanar problems with short run times. ERA

N77-26486# Physical Sciences, Inc., Woburn, Mass.
INVESTIGATION OF INDUCED UNIMOLECULAR DECOMPOSITION FOR DEVELOPMENT OF VISIBLE CHEMICAL LASERS Quarterly Progress Report, 1 Aug. - 30 Oct. 1976
L. G. Piper and R. L. Taylor Nov. 1976 22 p refs
(Contract EY-76-C-02-2920)
(COO-2920-2; PSI-TR-71) Avail: NTIS HC A02/MF A01

The methods available for the production of excited electronic states following azide decomposition are summarized. It is concluded that an experiment designed to study the kinetics of and branching ratios for electronically excited products from azide radicals reactions will be most productive in elucidating excitation mechanisms for potential chemical lasers. A flow reactor is described in which these studies may be undertaken. The major feature of this apparatus is a clean azide radical source based upon the thermal decomposition of solid, ionic azides. ERA

N77-26487# California Univ., Livermore. Lawrence Livermore Lab.
COMPACT ELECTRON ACCELERATOR FOR PUMPING GAS LASERS
C. V. Duncan and L. P. Bradley 22 Oct. 1976 7 p refs Presented at the IEEE Intern. Pulsed Power Conf., Lubbock, Tex., 9-11 Nov. 1976
(Contract W-7405-eng-48)
(UCRL-78537; Conf-761106-12) Avail: NTIS HC A02/MF A01

A description is given of the design and application of a simple e-beam generator for the repetitive pulse pumping of gas lasers. The circuit uses a low inductance Marx and series tuned pulse forming elements. ERA

N77-26488# Stanford Research Inst., Menlo Park, Calif.
RESEARCH ON HIGH-ENERGY STORAGE FOR LASER AMPLIFIERS Final Report
Graham Black 10 Dec. 1976 53 p refs
(Contract EY-76-C-03-0115-096; SRI Proj. PYU-3159)
(UCRL-13708; SRI-MP-76-107) Avail: NTIS HC A04/MF A01

Photodissociation techniques were applied to generate short-lived electronically excited species which may find application as photolytic light sources for both photodissociation and isotope separation. The experiments utilized a vacuum ultraviolet flashlamp with a lifetime of approximately 3 nsec and single photon detection. Measurements of radiative lifetimes and quenching properties are reported. ERA

N77-26489# Army Electronics Command, Fort Monmouth, N. J.
DEVELOPMENT OF SPECTROPHONES FOR CW AND PULSED RADIATION SOURCES
Charles Bruce Aug. 1976 70 p refs
(AD-A035594; ECOM-5802) Avail: NTIS HC A04/MF A01 CSCL 20/5

This technical report describes the construction of high sensitivity absorption measurement systems based on spectrophones 'opto-acoustical cells' which have been developed for both CW and pulsed laser sources. These systems have been applied to measurements of absorption by atmospheric gases and particulates at IR laser frequencies. Construction, calibration, and linearity are discussed for a number of specific systems. Accurate measurements of absorption by atmospheric constituents in the so-called transmission 'window' frequency bands are required by both the DOD high-energy laser HEL and electro-optical sensor programs. Statistical predictions for system design and the development of real-time field measurement systems are both important possible applications of spectrophones of the type discussed in this report. High sensitivity is generally a requirement as a result of the relatively low absorption in the 'windows.' Author (GRA)

N77-26490# Institut Franco-Allemand de Recherches, St. Louis (France).
EXPERIMENTAL DETERMINATION OF THE CONTRAST OF TWO INTERFERING ARGON LASER BEAMS [EXPERIMENTELLE BESTIMMUNG DES KONTRASTES INTERFERIERENDER ARGON-LASER-STRAHLEN]
H. J. Pfeifer and D. Mainone 14 Jun. 1976 18 p refs In GERMAN
(ISL-R-116/76) Avail: NTIS HC A02/MF A01

The contrast of two interfering partial beams from an argon-ion laser was measured as a function of the optical path difference and the output level in order to determine coherence length with a view to application to laser anemometry. The laser was operated without internal Fabry-Perot standard. The coherence properties at 488.0 nm were found to be better than at 514.5 nm. At maximum output level the loss of contrast was 10% for an optical path difference less than 1.5 cm. ESA

N77-26491# TRW Defense and Space Systems Group, Redondo Beach, Calif.
INVESTIGATION OF BEAMED ENERGY CONCEPTS FOR PROPULSION. VOLUME 1: SYSTEMS STUDIES Final Report, 2 Sep. 1975 - 1 Jul. 1976
M. Huberman, J. M. Sellen, R. Benson, W. Davenport, and R. Davidheiser Oct. 1976 259 p refs 2 Vol.
(Contract F04611-76-C-0003)
(AD-A034995; AFRPL-TR-76-66-Vol-1) Avail: NTIS HC A12/MF A01 CSCL 20/5

The objective of this program is to assess the feasibility of the beamed energy propulsion concept for Air Force missions. The results of the study indicate that beamed energy propulsion is technically feasible. No fundamental obstacles have been identified. However considerable technical development is needed in many areas before the concept can be operationally implemented. In order to minimize the required collector area, laser concepts are preferred over microwaves. If space based laser transmitter concepts are to be cost effective they will require the availability of megawatt level space nuclear or solar power stations. In view of the large total energy required for each mission, ground based transmitters will be most cost effective when they are operated closed cycle from central station electric power. Laser transmitting ranges greater than several hundred nautical miles will result in excessive collector sizes. Therefore, ground based transmitters applications will be restricted to orbital functions which can be performed at low orbital altitudes. Three promising applications have been identified. The laser powered tug can be cost effective compared to an advanced cryogenic tug. Apsidal rotation correction and drag make-up are two other missions where significant advantages may be realized for the laser powered concept. GRA

N77-26492# TRW Defense and Space Systems Group, Redondo Beach, Calif.
INVESTIGATION OF BEAMED ENERGY CONCEPTS FOR PROPULSION. VOLUME 2: LASER/PROPELLANT COUPLING ANALYSES Final Report, 2 Sep. 1975 - 1 Jul. 1976
M. Huberman, J. M. Sellen, R. Benson, W. Davenport, and R. Davidheiser Oct. 1976 132 p refs 2 Vol.
(Contract F04611-76-C-0003)
(AD-A035061; AFRPL-TR-76-66-Vol-2) Avail: NTIS

HC A07/MF A01 CSCL 20/5

The objective of this program is to assess the feasibility of the beamed energy propulsion concept for Air Force missions. The work is divided into three major tasks: (1) system studies; (2) theoretical analyses of the coupling mechanisms between the beamed energy and propellant working fluid and (3) preparation of a test plan for the experimental investigation of the coupling processes for various laser/propellant combinations. The results of the study indicate that beamed energy propulsion is technically feasible. No fundamental obstacles have been identified. However considerable technical development is needed in many areas before the concept can be operationally implemented. Three promising applications have been identified. The laser powered tug can be cost effective compared to an advanced cryogenic tug. Apsidal rotation correction and drag make-up are two other missions where significant advantages may be realized for the laser powered concept. Extensive hardware development is required. Critical areas include the lasers, thrusters, thruster reaction chamber windows and the collection and coupling subsystems. GRA

N77-26493# Perkin-Elmer Corp., Norwalk, Conn.

INTRINSIC AND THERMAL STRESS MODELING FOR THIN-FILM MULTILAYERS Semiannual Technical Report, May - Dec. 1976

A. M. Ledger and R. C. Bastien Dec. 1976 50 p refs

(Contract DAA25-76-C-0410; ARPA Order 3220)

(AD-A035513; PE-13262) Avail: NTIS HC A03/MF A01 CSCL 20/6

The measurement of induced stresses and thermally induced stresses in thin-film multilayer coatings is being investigated using an interferometric technique. Stress data is to be incorporated into a model for the prediction of thermally induced failure mechanisms in antireflection coatings for KCl windows at 10.6 micrometers. GRA

N77-26494# Naval Research Lab., Washington, D. C.

LASER-PRODUCED X-UV SPECTRA OF T6a AND W Interim Memorandum Report, Jan. - Dec. 1976

P. G. Burkhalter, D. J. Nagel, and Robert D. Cowan (Los Alamos Scientific Lab., N. Mex.) Jan. 1977 13 p refs Sponsored in part by ERDA

(NRL Proj. H02-43)

(AD-A035391; NRL-MR-3444) Avail: NTIS HC A02/MF A01 CSCL 07/4

Spectra of tantalum and tungsten in the 15-100 A region were obtained with a focused Nd:glass laser source coupled to a 600 line/mm grazing-incidence grating spectrograph. The spectral lines were identified as transitions to the 4p subshell. GRA

N77-26495# Hughes Research Labs., Malibu, Calif.

THE 10.6 MICRON PARAMETRIC FREQUENCY CONVERTER Final Technical Report, 1 Sep. 1974 - 30 Oct. 1976

C. K. Asawa and R. L. Abrams Dec. 1976 69 p refs

(Contract N00014-75-C-0089; ARPA Order 1806)

(AD-A035040) Avail: NTIS HC A04/MF A01 CSCL 20/5

Resonantly enhanced, single-sideband generation in a Stark tunable gas has been demonstrated, both theoretically and experimentally, for the first time. The theory was developed first; it predicted the possibility of parametric mixing of infrared and microwave radiation in deuterated ammonia (N14H2D) gas, which would result in down converted single-sideband radiation at the difference frequency. Quantitative prediction of the nonlinear effect was made and is contained in the expression for the induced nonlinear coefficient. Pressure and doppler broadening effects were accounted for in the coefficient. Successful experimental demonstration of resonantly enhanced, parametric single-sideband generation in N14H2D gas was made for the first time on this contract during October 1975. The P(20) line at 10.591 micrometers of the C12O216 laser and microwave at 4.023 GHz were mixed in a microwave-optical Stark cell, yielding a newly generated downconverted wave at 10.593 micrometers, or 944.061/cm. The dependences of the sideband signal on gas pressure, microwave frequency, applied dc field, and microwave power were measured and completely confirmed the theoretical predictions. A second experiment demonstrating resonantly enhanced parametric upconversion in Stark gas was also performed. GRA

N77-26496# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

LASER POINTING AND TRACKING USING AN ADAPTIVE EXTENDED KALMAN FILTER M.S. Thesis

Zdzislaw H. Lewantowicz Dec. 1976 153 p refs

(AD-A035275; GE/EE/76-29) Avail: NTIS HC A08/MF A01 CSCL 20/5

An adaptive extended Kalman filter (EKF) is used in an Adaptive Laser Optics Techniques (ALOT) control loop to track the glint from a spherical target. A fourfold improvement in tracking bandwidth is obtained over a conventional conical scan ALOT tracking loop implemented with the same hardware. The increase in tracking bandwidth is manifested in the ratio between the (conical scan) dither frequency and the tracking bandwidth which is 2.5:1 for the EKF and 10:1 for the conventional analog or digital glint tracking schemes. The EKF provides correct pointing error estimates over essentially the entire range of the pointing error, whereas in a conventional conical scan loop the demodulated error versus true pointing error function is highly non-linear due to the nonlinearity of the glint. GRA

N77-26497# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.

PLASMA CHEMISTRY PROCESSES IN PULSED ELECTRIC DISCHARGE LASERS Final Report, 11 Dec. 1975 - 30 Aug. 1976

Juergen Thoenes and Shelby C. Kurzius 30 Aug. 1976 69 p refs

(Contract DAAH03-75-A-0040)

(AD-A035036; LMSC-HREC-TR-D497000; RH-CR-76-12) Avail: NTIS HC A04/MF A01 CSCL 20/5

A theoretical model is developed to analyze plasma chemistry effects on the performance of pulsed, electron-beam sustained, electric discharge lasers. Predicted single pulse performance for a CO2 laser oscillator at 5 atm is found to be in excellent agreement with experiment. Analysis of several potential laser gas mixtures containing hydrogen in place of helium indicated that closed cycle operation and repetitive pulsing leads to a strong degradation of laser performance due to formation of electrophilic species. Important contaminants are identified, and their selective removal is shown to prevent degradation of laser performance. Author (GRA)

N77-26498# Army Electronics Command, Fort Monmouth, N. J.

POLYCHROMATIC, FLASHLAMP-PUMPED DYE LASERS

T. F. Ewanizky Jan. 1977 19 p refs

(DA Proj. 1T1-61101-A-91-A1750)

(AD-A037393; ECOM-4456) Avail: NTIS HC A02/MF A01 CSCL 20/5

Techniques were investigated in an effort to accomplish two separate objectives with an unstable resonator flashlamp-pumped dye laser. First, the use of dye mixtures to determine whether laser action, at various visible wavelenghts, could be simultaneously achieved from the different molecular species. Secondly, an optical system appropriate for broadband wavelength tunability of the unstable resonator laser was devised. Results showed that polychromatic laser radiation from dye mixtures has limited feasibility at least with presently available dyes. However, simultaneous blue-green and orange laser radiation was obtained with a coumarin-rhodamine mixture. A continuous timing range of over 30 nm was efficiently achieved using a single-stage, rotatory dispersive intracavity filter with rhodamine 6G. Author (GRA)

N77-26499# Washington State Univ., Pullman. Dept. of Chemistry.

CRYSTAL VIOLET AS A MODE-LOCKER OF THE RHODAMINE 6G DYE LASER Interim Technical Report

D. A. Cremers and Maurice W. Windsor 23 Mar. 1977 13 p refs Submitted for publication

(Contract N00014-75-C-0535; NR Proj. 051-524)

(AD-A037643; TR-12-ONR) Avail: NTIS HC A02/MF A01 CSCL 20/5

The ability of crystal violet to mode-lock the rhodamine 6G laser is reported. The relaxation time of crystal violet is solvent dependent. The manner in which the mode-locking is affected by varying this relaxation time is described a 2 mm path of a 0.00003 M solution of crystal violet in glycerol having a relaxation time of 100 ps, gave the best quality mode-locking for the 48 cm long x 8 mm diameter dye laser used. Author (GRA)

N77-26500# Ohio State Univ., Columbus. ElectroScience Lab.
LASER ATMOSPHERIC ABSORPTION STUDIES Interim Report, 1 Feb. - 31 Jul. 1976
R. K. Long Griffiss AFB, N. Y. RADC Jan. 1977 133 p refs
(Contract F30602-76-C-0058; ARPA Order 1279)
(AD-A036872; ESL-4232-2; RADC-TR-76-389) Avail: NTIS HC A07/MF A01 CSCL 20/5

This report describes progress on the various tasks which comprise the research in laser atmospheric propagation. This work includes: (1) a review of work done on the study of the infrared water vapor continuum, (2) the design of two stainless steel, temperature controlled absorption cells with White-type optics, (3) design of a non-resonant, differential spectrophone and data recorded on this instrument, (4) design of a stainless steel, resonant spectrophone, (5) and other topics. Author (GRA)

N77-26501# Science Applications, Inc., Ann Arbor, Mich.
DF LASER PROPAGATION ANALYSIS Final Report, 5 Jan. - 3 Dec. 1976
D. R. Wood, W. Flowers, R. E. Meredith, T. W. Tuer, and J. P. Walker Jan. 1977 91 p refs
(Contract N00173-76-C-0102)
(AD-A037813; SAI-77-001-AA) Avail: NTIS HC A05/MF A01 CSCL 20/5

Investigations in support of the NRL effort to obtain a field verified model of the atmospheric absorption of DF laser radiation are reported. New absorption line parameters have been extracted from spectroscopic data in the DF laser region. A simple analytic model has been developed for each DF laser line. The model allows the laser transmission to be simply calculated for any arbitrary temperature or humidity. The coefficients for this model are periodically updated by SAI, and the last set of coefficients is included in the report. Included also are plots of the functional dependence of DF laser transmission on temperature and humidity, and tables of the data used to obtain the coefficients. The atmospheric molecular transmission has been calculated and plotted for all wavelengths in the DF laser region (3.57 - 4.03 micrometers) and in the CO laser region (4.55 - 5.26 micrometers). Author (GRA)

N77-26502# ARO, Inc., Arnold Air Force Station, Tenn.
A LASER RAMAN SYSTEM FOR OBTAINING N2 AND CO2 CONCENTRATIONS IN PROBE-SAMPLED COMBUSTION GASES Final Report, Mar. 1975 - Jun. 1976
D. B. VanDyke and W. K. McGregor Mar. 1977 26 p refs
(AD-A037563; ARO-ETF-TR-76-107; AEDC-TR-77-5) Avail: NTIS HC A03/MF A01 CSCL 20/5

A system for obtaining N2 and CO2 concentrations in probe-sampled combustion gases by means of vibrational Raman scattering of an argon laser beam passed through a small cell located in the sample transfer line has been designed and tested. The detectors consisted of conventional photomultiplier tubes windowed by narrow bandpass (approximately 1 nm) interference filters and Rayleigh rejection filters. For N2, the center wavelength of the filter was 584.6 nm with a half-width of 1.2 nm, and for CO2, the wavelength was 554.1 nm with a half-width of 1.3 nm. Laboratory tests with calibration gases indicated excellent system linearity with respect to species concentration and partial pressure. The detection threshold was found to be approximately 1 percent at a sample pressure of 0.5 atm. The factors which determine this limit were photomultiplier noise levels and out-of-band leakage of the Raman interference filters.
Author (GRA)

N77-26503# Army Electronics Command, Fort Monmouth, N. J.
APPLICATION OF THE AN/GVS-5 LASER RANGEFINDER TO CLOUD BASE HEIGHT MEASUREMENTS
Robert S. Bonner and R. Newton Feb. 1977 48 p refs
(AD-A038013; ECOM-5812) Avail: NTIS HC A03/MF A01 CSCL 04/2

Current portable instruments utilizing a bistatic technique for measuring cloudbase heights are subject to large errors when the ceiling is greater than five times the instrument baseline. A hand-held, portable, low-cost, battery-operated laser range finder was evaluated for use as a cloud-base height instrument. The performance of the device was compared with the results obtained from several instruments designed as ceilometers, an AN/GMQ-13A rotating beam ceilometer, an Impulsphysik ceiloskop, and an ASEA ceilometer. For ceilings between 180 and 400 meters, data from all instruments showed the same long-term trends and similar short-term variators. For ceilings above 400 meters, the ceiloskop showed large errors compared to the other ceilometers, while the readings obtained from AN/GMQ-13A, the ceilometer, and the AN/GVS-5 compared favorably.
Author (GRA)

N77-26504# Westinghouse Defense and Electronic Systems Center, Baltimore, Md. Systems Development Div.
CAVITY DUMP-PTM Nd:LASER Final Report, Nov. 1973 - Mar. 1975
John L. Wentz and Gary D. Baldwin Jan. 1977 62 p refs
(Contract F33615-74-C-1011)
(AD-A037193; AFAL-TR-75-214) Avail: NTIS HC A04/MF A01 CSCL 20/5

Three major areas have been investigated with regard to obtaining high PRF/high average power operation from a solid state YAG:Nd laser: (1) application of high speed electro-optic modulation techniques to a high average power low gain laser device; (2) temporal modulation format required to obtain stable and efficient pulsed operation at PRF's between the classically accepted PTM and Cavity Dump (CD) frequency limits; (3) pulsed operation of dc Krypton arc lamp at 10 Hz (25% duty cycle) and subsequent pulse burst lasing at high PRF's. Employment of a dual crystal Pockels cell, fast switching modulator electronics with a variable duty cycle, and a hybrid resonator configuration has resulted in the attainment of stable Q-switched pulse trains over the PRF range of 0.1 to 1 MHz. During pulsed operation, overall efficiency was 85% of the CW maximum value, pulsewidth was 40 nanoseconds, pulse amplitude stability better than + or - 10%, and average power levels exceeding 10 watts were obtained. Over the 0.1 to 1 MHz range, average output power and pulsewidth were found to be independent of PRF.
Author (GRA)

N77-26505# Naval Research Lab., Washington, D. C.
DYNAMIC STABILIZATION OF THE RAYLEIGH-TAYLOR INSTABILITY ON LASER-IMPLODED SHELLS
J. P. Boris Dec. 1976 41 p refs
(RR0110941)
(AD-A035605; NRL-MR-3427) Avail: NTIS HC A03/MF A01 CSCL 20/4

By continually modulating the intensity of the driving laser beams, the fastest-growing modes of Rayleigh-Taylor instability on the surface of an imploding laser fusion pellet can be dynamically stabilized. Both theory and numerical simulation are presented to support this conclusion. The band of modes stabilized extends to sufficiently long wavelength that rather high aspect ratio shells apparently can be imploded successfully. Similar beam modulation or bunching techniques should work for electron, ion and heavy ion pellet implosion schemes. Author (GRA)

N77-26506# California Univ., Irvine. Dept. of Chemistry.
A SIMPLE, HIGH-POWER, LOW-COST NITROGEN LASER FOR DYE LASER PUMPING Technical Report, 1 Apr. 1976 - 31 Mar. 1977
Amnon Fisher, Jon Peacock, and Edward K. F. Lee 28 Jan. 1977 15 p refs
(Contract N00014-75-C-0813)
(AD-A035580; B-12) Avail: NTIS HC A02/MF A01 CSCL 20/5

The design and construction of a simple, low cost, high power nitrogen laser is reported. The laser meets the optimum requirements for a dye laser pump source 10-12 nsec FWHM, 1 MW peak power, high peak-to-peak stability, a no optimum

operation to 50 pps. A novel electrode design and circular output beam cross section are emphasized. Author (GRA)

N77-26507# Army Environmental Hygiene Agency, Aberdeen Proving Ground, Md.
OPTICAL HAZARDS OF WEATHER SERVICE INSTRUMENTATION, JANUARY 1977
David H. Sliney, Wesley J. Marshall, and Pedro F. DelValle Jan. 1977 21 p refs
(AD-A037617; USAEHA-42-0321-77) Avail: NTIS HC A02/MF A01 CSCL 06/18

A nonionizing radiation protection special study of five types of weather instruments was performed by the U.S. Army Environmental Hygiene Agency during January 1977. It was determined that the three ceilometers, one transmissometer and a laser weather identifier did not represent optical hazards under normal use for expected viewing conditions. However, during maintenance or testing, it was conceivable that optically aided viewing within the beams of these instruments could be hazardous. Author (GRA)

N77-26508# Army Environmental Hygiene Agency, Aberdeen Proving Ground, Md.
EVALUATION OF A LASER EQUIPPED RIFLE FOR THE US ARMY HUMAN ENGINEERING LABORATORY, ABERDEEN PROVING GROUND, MARYLAND, 19 JANUARY 1977
Terry L. Lyon and Pedro F. DelValle Jan. 1977 20 p
(AD-A037615; USAEHA-42-0325-77) Avail: NTIS HC A02/MF A01 CSCL 06/18

A special study of the optical radiation hazards associated with the operation of a He-Ne laser mounted to an American International Corporation Model 180 Law Enforcement Rifle was performed by this Agency. Radiometric measurements were conducted on 11 January 1977, for the U.S. Army Human Engineering Laboratory at Aberdeen Proving Ground. It was determined that the protection standards for momentary viewing were exceeded out to a hazard distance of 9 m and to 100 m when viewing through an optical instrument. Long-term staring at the laser from within the beam exceeded the protection standards out to a caution distance of 490 m. Author (GRA)

N77-26509# Riverside Research Inst., New York.
PHOTOCOUNTING IMAGE TRACKING OF FLUCTUATING TARGETS
Marek Elbaum Feb. 1977 124 p refs
(Contract DAAK40-76-C-0500; ARPA Order 2281)
(AD-A037774; RRI-T-1/364-3-65) Avail: NTIS HC A06/MF A01 CSCL 17/8

A theory of estimation of angular position and other attributes of optically rough and smooth targets with a monopulse laser radar is developed. It applies to systems deriving information about the target position by sensing its image with an array of noncoherent detectors. The theory develops quantitative formulations of the fundamental limitations imposed upon measurement accuracy by the shot noise arising from both the target return and the background radiation, by the detector dark current, and by the random fluctuations of the target cross section. Author (GRA)

N77-26510# Systems Science and Software, Hayward, Calif.
INVESTIGATION OF COUPLING OF FIELD EMISSION COLD CATHODE GUNS FOR GAS LASERS Final Technical Report
G. Loda and D. A. Meskan 4 Feb. 1977 187 p
(Contract DAAH01-74-C-0624; DA Proj. 1X3-63314-D-093)
(AD-A037734; DRDMI-H-77-1) Avail: NTIS HC A09/MF A01 CSCL 09/1

Contents: Repetitive pulse cold cathode technology in system applications, Grid controlled cold cathode guns: Analysis and calculations, Grid controlled cold cathode guns' Measurements; and Conceptual design for a 7.5-kW beam power cold cathode gun. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N77-26511 British Library Lending Div., Boston Spa (England).
AIR-SUPPLY UNITS OF COMBINATION INTERNAL COMBUSTION ENGINES
M. G. Kruglov Apr. 1977 68 p Transl. into ENGLISH from the book "Agregaty vozdukhosnabzheniya kombinirovannykh dvigatelei vnutrennogo sgoraniya", Moscow, 1973 p 3-4, 23-69, 296
(BLL-RTS-9748) Avail: British Library Lending Div., Boston Spa, Engl.: £ 15.00; 14 BLL overseas, 15 European or 60 UK BLL photocopy coupons

Some of the following are reviewed: (1) combustion engines and their requirements for air supply units; (2) the significance of a compressor in the air supply system; (3) cooling the air feed to cylinders; (4) types of turbines of combustion engines; and (5) coordination of characteristics and joint functioning of turbines, compressors and piston units. Methods for making calculations for centrifugal compressors were described. B.B.

N77-26512 Accession number not used.

N77-26513# Drexel Univ., Philadelphia, Pa.
DESIGN CURVES FOR STRUCTURAL RESPONSE DUE TO IMPACT LOADING Final Contract Report, Jul. 1975 - Jun. 1976
Pei Chi Chou and William J. Flis Oct. 1976 79 p
(Contract N62269-75-C-0425)
(AD-A037011; NADC-76380-30) Avail: NTIS HC A05/MF A01 CSCL 13/13

A method is developed to produce a design curve for predicting the response of a given type of structure to impact loading. This curve gives the maximum strain in the structure, which may have various size and material properties, due to impacts involving different masses and velocities. An example of a simply supported beam under central impact is presented in detail. Both experimental results and numerical calculations were used in establishing the design curve. This curve implies that, for large impactor masses, the controlling parameter is the ratio of structural to impactor mass; the strain is linearly proportional to impact velocity and inversely proportional to the square root of the mass ratio. Author (GRA)

N77-26514# Bendix Corp., Kansas City, Mo.
CASTING WARPAGE STUDY Final Report
E. P. Patterson Aug. 1976 80 p refs
(Contract E(29-1)-613)
(BDX-613-1368; PDO-6984517) Avail: NTIS HC A05/MF A01

An experiment was designed to include solutions along with polyethylene glycol solutions in a study of quenching parameters. A total of 1032 cast parts was produced from 13 cast-furnace heats for study. Conclusions concerning warpage and mechanical properties were based on 2064 tensile specimens and the cast parts. Warpage was reduced signficantly in the two glycol-solution

systems. Solutions of 20 and 40 percent, by weight, appeared to be more effective for both polyethylene glycol and polyalkylene glycol. Minimum warpage occurred at a quenching temperature of 210 F (98.9 C). Warpage in the glycol quenching solutions was less than that which occurred in water at all temperatures studied. ERA

N77-26515# Sandia Labs., Albuquerque, N. Mex.
ION PLATING: CONCEPTS AND APPLICATIONS
D. M. Mattox 1976 19 p refs Presented at 25th Symp. on Mech. Failures Prevention Group, Gaithersburg, Md., 3 Nov. 1976
(Contract E(29-1)-789)
(SAND-76-5459; Conf-761147) Avail: NTIS HC A02/MF A01

In ion plating, the substrate is bombarded by high-energy ions to cause sputtering before and during interface formation. This is usually done with the substrate immersed in a gas discharge while a dc or RF potential is applied to the surface. This results in improved adhesion and improved coating properties. The process is described in detail, particularly the pre-cleaning, energy deposition, interface formation, and film properties. Some of the applications of this process in Japan and the U.S. are described briefly. ERA

N77-26516# Idaho National Engineering Lab., Idaho Falls.
MODIFICATION TECHNIQUES AND PERFORMANCE CHARACTERISTICS OF HYDROGEN-POWERED IC ENGINES: STATE OF THE ART, 1975
F. B. Simpson, J. H. Lofthouse, D. R. Swope, and R. L. Wooley (Billings Energy Research Corp., Provo, Utah) Sep. 1976 28 p refs
(Contract E(10-1)-1375)
(ANCR-1302) Avail: NTIS HC A03/MF A01

Over the past quarter of a century there has been a significant amount of work on modification of internal combustion (IC) engines to operate on hydrogen. However, comparisons are difficult because of large variation in designs, engine parameters, and test conditions. A comparative summary of the recent work on hydrogen-powered engines is presented under a unifying format. This summary includes material extracted from published reports and obtained by private communication. It is intended that this survey be of value to those beginning work in the field and will provide some guidance in determining the direction of future research. Included are the following: engine parameters, modifications, operating conditions, running characteristics, performance, and related comments. More detailed discussion is included on the manpower and material costs associated with the modification of one of the engines listed. ERA

N77-26517# California Univ., Livermore. Lawrence Livermore Lab.
NUMERICAL SOLUTION OF THE SPRAY EQUATION
Charles Westbrook Nov. 1976 40 p refs
(Contract W-7405-eng-48)
(UCID-17361) Avail: NTIS HC A03/MF A01

The spray equation was solved numerically using a statistical approach. The method was applied to physical systems were all three space coordinates are independent, in an internal combustion engine with asymmetric liquid fuel injection. For physical configurations in which some degree of symmetry exists, the numerical model is simplified, at a considerable savings in computer time. Difference equations are derived for the spray equation in one, two, and three dimensions. In three dimensions the equations are given in Cartesian and cylindrical coordinates. Quantities of physical interest which can be calculated from the droplet distribution function are defined. Coupling terms for use in combined spray-gas phase hydrodynamics models are derived, conserving the total mass, momentum, and energy of the two-phase system. The spray model is extended to allow for denser sprays in which the thin spray approximation is no longer valid. ERA

N77-26518# Bari Univ. (Italy). Ist. di Costruzione di Macchine.
CONSTRUCTION OF THE THREE-DIMENSIONAL NUMERICAL MODEL OF AN AUTOMOTIVE WHEEL HUB [COSTRUZIONE DEL MODELLO NUMERICO TRIDIMENSIONALE DEL PORTAMOZZO DI UN'AUTOVETTURA]
A. Francavilla and S. DeMatthaeis 13 Oct. 1976 12 p refs In ITALIAN; ENGLISH summary Presented at 3rd Congr. Nazl. dell'Assoc. Ital. di Meccan. Teorica ed Appl., Cagliari, 13-16 Oct. 1976
(Contract CNR-75.01281)
Avail: NTIS HC A02/MF A01

The structural analysis of an automobile wheel hub by means of subdivision in solid three-dimensional elements is dealt with. The different stages of the procedure are demonstrated, pointing out the difficulties encountered and the techniques used to overcome them. ESA

N77-26519# Army Materiel Development And Readiness Command, Alexandria, Va.
ENGINEERING DESIGN HANDBOOK: ANALYSIS AND DESIGN OF AUTOMOTIVE BRAKE SYSTEMS
1 Dec. 1976 255 p refs
(AD-A035143; DARCOM-P-706-358) Avail: NTIS HC A12/MF A01 CSCL 19/3

This handbook treats the braking of motor vehicles such as passenger cars, trucks, and trailers. No attempt has been made to address fully the braking of specialty vehicles. However, the engineering relationships presented can be applied to the analysis of any automotive braking system, including those of tanks and special carriers. The text is structured so that it can be used by junior engineers with a minimum of supervision provided by a senior engineer. Chapters 2, 3, 4, 5, and 6 present the analysis of brake system components and should provide sufficient detail for the computations required for the analysis of entire brake systems. Chapter 7 and those that follow address the analysis and design of the brake system of motor vehicles including the computation of partial braking performance with the brake system in a failed condition. The examples in Chapter 14 are presented in considerable detail to provide the engineer with insight into the methodology used in solving brake problems. A brief description of brake system hardware is provided in Chapter 15 for the engineer not fully familiar with the functioning of various brake system components. GRA

N77-26520# Southwest Research Inst., San Antonio, Tex.
MODEL ANALYSIS FOR PENETRATION OF SPACED ARMOR
W. E. Baker and P. S. Westine Jan. 1977 61 p refs
(Contract DAAD05-75-C-0757)
(AD-A035460; BRL-CR-327) Avail: NTIS HC A04/MF A01 CSCL 19/1

This report includes a discussion and similitude analysis of the penetration of space armor by dense, long rod projectiles. Many geometric and physical parameters are included in the analysis. A general scale model law is given, and the implications of replica and dissimilar material assumptions are disscussed in detail. Very few scaling parameters are distorted for either assumption. A model validation test program is recommeded for both the replica and dissimilar material assumptions. Practical lower limits on model scale and statistical methods for comparing model and prototype data are briefly discussed. GRA

N77-26521# Ballistic Research Labs., Aberdeen Proving Ground, Md.
ANALYSIS OF THE FRICTION BEHAVIOR AT HIGH SLIDING VELOCITIES AND PRESSURE FOR GILDING METAL, ANNEALED IRON, COPPER AND PROJECTILE STEEL
James O. Pilcher, II and Emma M. Wineholt Jan. 1977 70 p refs
(DA Proj. 1X6-63606-D-006)
(AD-A035674; BRL-1955) Avail: NTIS HC A04/MF A01 CSCL 19/4

Through the numerical analyses of the data presented in the Benet Weapons Laboratory Report No. WVT - TR -75028, 'Friction and Wear at High Sliding Speeds', and dimensional analysis incorporating findings of Prandtl, Grosch and Plake, Bowden, Archard and W. R. D. Wilson, a formulation is developed equating the coefficient of friction to the normal pressure, sliding velocity, strength and thermodynamical properties of the slider. This equation is for an elastic-plastic slider sliding on a dry, rigid surface similar to the conditions in interior ballistic environments. GRA

N77-26522# Washington Univ., Seattle. Applied Physics Lab.
INTERFERENCE SEALS AND CONNECTORS FOR UNDERSEA ELECTRICAL APPLICATIONS
James Paradis Jul. 1976 319 p refs
(Contract N00017-74-C-1208)
(AD-A036841)' Avail: NTIS HC A14/MF A01 CSCL 13/10

This manual investigates the factors involved in the theory and design of underwater cable seals or packings of the interference type. It established standards for the sizes, proportions and materials for component parts, and for assemblies of seals with both single and multiple packings. It classifies commercially available underwater electrical connector series according to their material composition, and describes them through the use of a standard matrix which lists several critical design features. It supplies manufacturers' addresses and a list of significant users of their underwater electrical connectors. Additional organizations with special underwater electrical connector design capabilities are also listed. The manual also identifies and describes the most common failure modes in submerged electrical connectors and describes practiced methods of preventing failures.
Author (GRA)

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N77-26523# Kaman Aerospace Corp., Bloomfield, Conn.
LABORATORY VERIFICATION OF FORCE DETERMINATION, A POTENTIAL TOOL FOR RELIABILITY TESTING Final Report
William G. Flannelly, Felton D. Bartlett, Jr., and Thomas W. Forsberg Jan. 1977 115 p refs
(Contract DAAJ02-75-C-0004)
(AD-A035960; R-1457; USAAMRDL-TR-76-38) Avail: NTIS HC A06/MF A01 CSCL 20/11

Results of laboratory tests on a helicopter dynamic model show that the external vibratory forces, such as those of main and tail rotors, acting on a helicopter can be accurately determined from flight tests using only accelerometers in the fuselage. GRA

N77-26524# Defense Systems Management School, Fort Belvoir, Va.
A PRACTICAL GUIDE TO RELIABILITY Student Project Report
Edward M. Lee, Jr. Nov. 1976 57 p refs
(AD-A037611) Avail: NTIS HC A04/MF A01 CSCL 14/4

Most reliability references place heavy emphasis on the mathematics of measuring reliability and relatively little emphasis on the actions which contribute to a product's reliability. This booklet emphasizes how reliability is achieved during the military systems acquisition process. It is aimed at those involved in project management and others who require an introductory reference of reliability principles and practices. After a brief discussion of reliability definitions and concepts, the booklet traces reliability program efforts beginning with the setting of realistic requirements and continuing through design, development, and production. GRA

N77-26525# Defense Systems Management School, Fort Belvoir, Va.
THE EFFECT OF RELIABILITY AND MAINTAINABILITY ON THE F-14A TF30P412A ENGINE
Bruce N. Erickson Nov. 1976 82 p refs
(AD-A037985) Avail: NTIS HC A05/MF A01 CSCL 01/3

This report covers a brief history of the TF30P412A Engine and the F-14A's capabilities, the present military specification for aircraft engine testing, analysis of major components of the TF30P412A reliability and maintainability (RAM) and their affect on availability and the logistics support system. It can be concluded from the report that our present system for developing and testing aircraft engines needs to be improved and that the TF30P412A is a result of the inadequate process. The low operational readiness of the F-14A can in part be blamed on the TF30P412A engine's low RAM. The supply problem has grown due to a proliferating parts problem resulting from numerous Engineering Change Proposals (ECP's). It is recommended that the Navy: continue to place more emphasis on reliability in the future; establish a Joint Engine Program Office with the Air Force; establish a 1,000 hour mission test for engine development; should give reliability priority over increased technical performance in the development of a new engine; and compare RAM figures for all the turbofan engines. Author (GRA)

N77-26526# IRT Corp., San Diego, Calif.
EVALUATION OF CALIFORNIUM-252-BASED NEUTRON RADIOGRAPHY AND PHOTON SCATTERING TECHNIQUES FOR THE INSPECTION OF HOT ISO-STATICALLY PRESSED COMPONENTS OF T-700 AIRCRAFT ENGINE Final Report
H. Harper, J. C. Young, J. Baltgalvis, Hans Weber, and Joseph John Aug. 1976 87 p refs
(Contract DAAJ01-75-C-0895)
(AD-A036000; IRT-6102-003; USAAVSCOM-TR-76-24) Avail: NTIS HC A05/MF A01 CSCL 14/2

The evaluation of two nondestructive testing (NDT) techniques for the flaw inspection of turbine disk material for the General Electric T-700 engine is described. The material which is produced by the Hot Iso-Static Pressing (HIP) technique introduces a new set of NDT requirements and problems. The first evaluated is neutron radiographic inspection. It proves to be capable of detecting flaws however, a certain degree of development work is required to improve its resolution capability. A newly developed Photon Scattering Gauge is evaluated as the second technique. Although tailored for the inspection of explosive filler in 105-mm projectiles, the existing test instrument demonstrates the feasibility of the technique for the inspection of HIP turbine parts. The response of the Photon Scattering Gauge is three dimensional. It is characterized by its high-resolution capability.
Author (GRA)

N77-26527# Florida State Univ., Tallahassee. Dept. of Statistics.
TRANSFORMATION YIELDING RELIABILITY MODELS BASED ON INDEPENDENT RANDOM VARIABLES: A SURVEY Interim Report
N. Langberg, A. J. Quinzi, and F. Proschan Jan. 1977 25 p refs
(AD-A037969; FSU-Statistics-M399; AFOSR-77-0254TR; TR-69) Avail: NTIS HC A02/MF A01 CSCL 12/1

This is an expository paper presenting various ways of transforming dependent models into independent ones and displaying applications in variety of contexts including reliability modelling, life testing, and nonparametric estimation in the study of competing risks. Author (GRA)

N77-26528# IIT Research Inst., Chicago, Ill.
UPDATE TO RELIABILITY AND MAINTAINABILITY PLANNING GUIDE FOR ARMY AVIATION SYSTEMS AND COMPONENTS Final Report, Jul. 1975 - Aug. 1976
Peter A. Mihalkanin Aug. 1976 428 p refs
(Contract DAAJ01-75-C-1094)
(AD-A037446; IITRI-E6337-FR; USAAVSCOM-TR-77-15) Avail: NTIS HC A19/MF A01 CSCL 15/3

This guidebook has been prepared to serve as a tool for the R and M Division of AVSCOM and for Program Managers to use in planning, managing and monitoring R and M programs for aviation systems. Included in the guidebook are basic concepts, program provisions, guidelines, recommendations and specific R and M plans and procedures. The various provisions presented in this guidebook were formulated to meet the specific mission needs of AVSCOM's R and M Division, and are planned for use in support of the acquisition, operation and maintenance of Army aircraft systems and components. The major thrust of the guidebook is directed toward activities that take place during system development and production. Emphasis has been placed on mechanical reliability prediction, reliability growth testing, fault-tree analysis, and production reliability assurance techniques with specific examples applicable to helicopter systems. GRA

N77-26529# Watervliet Arsenal, N.Y.
COMPUTER CONTROLLED X-RAY STRESS ANALYSIS FOR INSPECTION OF MANUFACTURED COMPONENTS
G. P. Capsimalis, R. F. Haggerty, and K. Loomis Jan. 1977 37 p refs
(AD-A037350; WVT-TR-77001) Avail: NTIS HC A03/MF A01 CSCL 14/2

A portable X-ray system has been constructed to measure automatically the surface residual stresses of gun tubes and other weapon components. The system includes a stress goniometer powered by a full wave X-ray generator and a set of modular electronics which consist of a dual axis positioner, a universal timer-scaler and a telecomputer interface for communicating with a minicomputer. The system is controlled by a minicomputer having 12K words of memory, 1.2M-word removable-cartridge disk and can implement entire problem solutions using FORTRAN IV. All operations of the stress goniometer, the modular electonic hardware, logic operations and data processing are performed in real time and are completely computer controlled. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N77-26530 British Library Lending Div., Boston Spa (England).
CALCULATION OF INTERNAL WELD STRESSES AND WELD DEFORMATIONS BY MEANS OF ELASTO-PLASTIC FINITE ELEMENTS
Dieter Radaj Feb. 1977 28 p refs Transl into ENGLISH from Schweissen Schneiden (West Ger.), v. 27, no. 7, 1975 p 245-250
(BLL-RTS-10440) Avail: British Library Lending Div., Boston Spa, Engl.: £15.00; 14 BLL Overseas, 15 European or 60 UK BLL photocopy coupons

The mathematical finite element analysis of the welding process and structures are reviewed. A systematic analysis of the elastoplastic finite element analysis method is also included. Research and development and suggestions in the area studied are given. Author

N77-26531 British Library Lending Div., Boston Spa (England).
APPROXIMATE METHOD FOR STRENGTH ANALYSIS OF CIRCULAR AXIALLY SYMMETRIC PLATES OF VARIABLE THICKNESS, WITH RIBS ON ONE SIDE AND SUBJECT TO AN AXIALLY SYMMETRIC LOAD
J. Leyko, M. Krolak, and A. Motkowski Jan. 1977 18 p refs Transl. into ENGLISH from Archiwum Budowy Maszyn (USSR), v. 19, no. 3, 1972 p 421-434
(BLL-RTS-10426) Avail: British Library Lending Div., Boston Spa, Engl.: £7.50; 7 BLL overseas, 8 European or 30 UK BLL photocopy coupons

An approximate method of analysis of deformation and the state of stress in a circular axially symmetric plate of variable thickness is presented. The plate is reinforced on one side with radial ribs of variable cross section and is subject to the action of an axially symmetric load and an established axially symmetric temperature field. The plate was divided into finite elements to get an approximate solution. Two differential equations of equilibrium were obtained for each of these plates. The solutions of these equations were expressed in terms of elementary functions, and the arbitrary constant appearing in the equations was determined from the continuity conditions for the displacements and for the cross section forces at the boundaries of the elements into which the entire plate was divided. Author

N77-26532*# Houston Univ., Tex. Dept. of Mechanical Engineering.
IDENTIFICATION OF NATURAL FREQUENCIES AND MODAL DAMPING RATIOS OF AEROSPACE STRUCTURES FROM RESPONSE DATA
C. D. Michalopoulos Nov. 1976 36 p refs
(Contract NAS9-14347)
(NASA-CR-151419; TR-NC-1) Avail: NTIS HC A03/MF A01 CSCL 13M

An analysis of one and multidegree of freedom systems with classical damping is presented. Definition and minimization of error functions for each system are discussed. Systems with classical and nonclassical normal modes are studied, and results for first order perturbation are given. An alternative method of matching power spectral densities is provided, and numerical results are reviewed. B.B.

N77-26533*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE GENERAL SOLUTION TO THE CLASSICAL PROBLEM OF FINITE EULER BERNOULLI BEAM
M. Y. Hussaini and C. L. Amba-Rao (Vikram Sarabhai Space Center, Trivandrum, India) Jun. 1977 13 p refs
(NASA-TM-X-73253; A-7076) Avail: NTIS HC A02/MF A01 CSCL 20K

An analytical solution is obtained for the problem of free and forced vibrations of a finite Euler Bernoulli beam with arbitrary (partially fixed) boundary conditions. The effects of linear viscous damping, Winkler foundation, constant axial tension, a concentrated mass, and an arbitrary forcing function are included in the analysis. No restriction is placed on the values of the parameters involved, and the solution presented here contains all cited previous solutions as special cases. Author

N77-26534*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
NONLINEAR ANALYSIS OF BONDED JOINTS WITH THERMAL EFFECTS Interim Report, Sep. 1975 - May 1977
Edward A. Humphreys and Carl T. Herakovich Jun. 1977 201 p refs
(Grant NGR-47-004-090)
(NASA-CR-153263; VPI-E-77-19) Avail: NTIS HC A10/MF A01 CSCL 20K

Nonlinear results are presented for adhesive bonded joints. It is shown that adhesive nonlinearities are only significant in the predicted adhesive shear stresses. Adherend nonlinearities and temperature dependent properties are shown to have little effect upon the adhesive stress predictions under mechanical and thermal loadings. Author

N77-26535# Office of Naval Research, London (England).
THE MARINE GAS TURBINE: THE UK PROVIDES A CASE STUDY IN TECHNOLOGICAL DEVELOPMENT
Robert H. Nunn 25 Feb. 1977 30 p refs
(AD-A037686; ONRL-R-1-77) Avail: NTIS HC A03/MF A01 CSCL 21/5

This report provides a review of the history of marine gas turbines (MGTs) as propulsors for the Royal Navy, and some of the technological extensions that now appear to be especially promising. Beginning with the Gatric engine in 1943, successive engines are described which, in 1967, provided the confidence necessary for the UK to opt for total MGT propulsion in future naval surface craft. The developments from 1967 onward are briefly summarized, and the current state-of-the-technology is described. Special attention is given to gas generators and their associated ducting systems for use aboard ship. Author (GRA)

N77-26536# Weidlinger Associates, New York.
NOTE ON THE DYNAMIC BUCKLING OF ELASTO-PLASTIC STRUCTURES
M. P. Bieniek Oct. 1976 58 p refs
(Contract N00014-72-C-0119)
(AD-A035964) Avail: NTIS HC A04/MF A01 CSCL 20/11

This note reviews several topics related to the analysis of dynamic buckling and post-buckling behavior of elasto-plastic structures. It is aimed at providing a background for a dynamic elastic-plastic structural analysis code that is being developed to study the dynamic buckling and post-buckling behavior of submerged structures under transient pressure loadings. GRA

N77-26537# Weidlinger Associates, New York.
NUMERICAL ANALYSIS OF THE DYNAMIC RESPONSE OF ELASTO-PLASTIC SHELLS

M. P. Bieniek, J. Funaro, and M. L. Baron Nov. 1976 70 p refs
(Contract N00014-72-C-011923)
(AD-A035965; TR-20) Avail: NTIS HC A04/MF A01 CSCL 20/11

An efficient numerical procedure for the transient dynamic analysis of the elasto-plastic shells is introduced. A simple shell is analyzed and the results achieved are compared against an existing code. Author (GRA)

N77-26538# Frankford Arsenal, Philadelphia, Pa.
AN IMPROVED METHOD OF DETERMINING SHOCK TEST SPECIFICATIONS FOR FIRE CONTROL EQUIPMENT Technical Research Report
James H. Wiland, Alfred J. Kase, and Richard S. Holland Jun. 1976 94 p refs
(AD-A037618; FA-TR-76030) Avail: NTIS HC A05/MF A01 CSCL 19/5

This program was conducted to improve the procedure for developing and executing specification laboratory shock tests of production type fire control instruments (FC). Many laboratory tests were conducted using FC of M29 Mortar, M102 Howitzer, and M551 Sheridan Vehicle, since on a structural dynamics basis these instruments represent most FC Groups. For various g levels and impulse times, each instrument's resulting laboratory shock test spectra from each combination of location and direction were compared to composite field spectra from that same combination for correlation. Reported here is a recommended selection of proper g levels with corresponding impulse times which produce adequate laboratory simulation of field results without severe over (or under) - testing or erroneous, laboratory induced failure. Additional benefits are: (1) a reduction in present number of specified shock tests without significant information loss, (2) good simulation of field results using standard commercially available shock machines, (3) substantial cost reduction via less complex test procedure and simpler fixturing. GRA

N77-26539# Ballistic Research Labs., Aberdeen Proving Ground, Md.
STRESSES PRODUCED IN A LONG CYLINDER BY A NUCLEAR THERMAL ENVIRONMENT Final Report
Ennis F. Quigley Feb. 1977 32 p
(AD-A037426; BRL-1962) Avail: NTIS HC A03/MF A01 CSCL 18/3

This report contains the plane strain derivation of a set of non-dimensional equations for the quasi-static, thermal stress field in a long, unrestrained, isotropic, homogeneous, solid cylinder whose lateral surface is subjected to heating by a nuclear thermal pulse. Included are the results of a parametric analysis of the stress field as a function of the rise time of the thermal pulse and the total energy of the pulse. Author (GRA)

N77-26540# Argonne National Lab., Ill.
AIR BLAST EFFECTS ON CONCRETE WALLS
C. A. Kot and P. Turula Jul. 1976 67 p refs
(Contract W-31-109-eng-38)
(ANL-CT-76-50) Avail: NTIS HC A04/MF A01

Estimates are obtained both for the spalling of the back-face of the concrete wall and for the overall wall response produced by the total impulsive load of the air blast. Assuming elastic wave propagation in the concrete wall, it is found that as spall thickness increases, the spall velocity decreases. This holds for normal as well as oblique wave incidence on the back-face of the wall. Therefore, for debris which has significant mass, the ejection velocity produced by spalling action alone is quite moderate. Plastic yield-line analysis of the wall segment subjected to the impulsive loading of the air blast indicates that for sufficiently large explosions substantial displacements and peak velocities can occur in typical shield walls. ERA

N77-26541# Rochester Univ., N. Y.
MATERIALS AND MECHANICS OF RATE EFFECTS IN BRITTLE FRACTURE Progress Report, Oct. 1975 - Oct. 1976
S. J. Burns 1976 8 p
(Contract EY-76-S-02-2422)
(COO-2422-08) Avail: NTIS HC A02/MF A01

The slow, isothermal, propagation of cracks was analyzed by introducing the fracture mechanics concepts into molecular rate theory. Relations between thermodynamic variables and measurable quantities such as crack velocities, specimen temperature and crack extension force were derived. The shape and distribution of the rate controlling obstacles were left unspecified in the theory. The theory was applied to published crack propagation data in PMMA and agreement between theory and data is found. A literature survey of crack velocity data in a wide selection of materials including inorganic glasses, ceramics, polymers and metals shows the correlation that the crack extension force is inversely proportional to the crack activation area. In rapid crack propagation, a new technique, measuring the complimentary boundary condition to the applied boundary condition was used to deduce the stress intensity factor and the crack velocity during crack propagation in DCB specimens. The technique is eaiser to use and gives better results than the electropotential methods of measuring crack length during rapid fracture. The shear force in a rapidly wedged DCB specimen is multiplied by the square root of the time after the wedge strikes the specimen, this product is nearly constant during fracture. ERA

N77-26542# General Electric Co., Schenectady, N.Y.
CONCEPT OF FREQUENCY SEPARATION IN LIFE PREDICTION FOR TIME-DEPENDENT FATIGUE
L. F. Coffin 1976 37 p refs Presented at Ann. Meeting of the Am. Soc. of Mech. Eng., New York, 29 Nov. 1976
(Contract W-7405-eng-26)
(CONF-761107-14) Avail: NTIS HC A03/MF A01

Two methods are described to improve the predictive capability of the frequency-modified fatigue equations for time dependent fatigue. These built on the earlier approach and are applicable to severely unbalanced hysteresis loops. Comparisons made with various wave-shape investigations show favorable results. A new form of hysteresis loop is introduced utilizing frequency separation concepts. ERA

N77-26543# California Univ., Livermore. Lawrence Livermore Lab.
MULTIPLE-ACTUATOR SHAKER DIGITAL CONTROL SYSTEM
Dennis K. Fisher and Michael R. Posehn 1 Nov. 1976 44 p refs Presented at the 47th Shock and Vibration Symp., Albuquerque, N. Mex., 19-21 Oct. 1976
(Contract W-7405-eng-48)
(UCRL-78340; Conf-761062) Avail: NTIS HC A03/MF A01

The theoretical basis is reviewed, and the implementation and performance characteristics of the completed system are described. ERA

N77-26544# Argonne National Lab., Ill. Components Technology Division.
ANALYSIS OF A CYLINDRICAL SHELL VIBRATING IN A CYLINDRICAL FLUID REGION
H. Chung, P. Turula, T. M. Mulcahy, and J. A. Jendrzejczyk Aug. 1976 24 p refs
(Contract W-31-109-eng-38)
(ANL-76-48) Avail: NTIS HC A02/MF A01

Analytical and experimental methods are presented for evaluating the vibration characteristics of cylindrical shells such as the thermal liner of the Fast Flux Test Facility (FFTF) reactor vessel. The NASTRAN computer program is used to calculate the natural frequencies, mode shapes, and response to a harmonic loading of a thin, circular cylindrical shell situated inside a fluid-filled rigid circular cylinder. Solutions in a vacuum are verified with an exact solution method and the SAP IV computer code. Comparisons between analysis and experiment are made, and the accuracy and utility of the fluid-solid interaction package of NASTRAN is assessed. ERA

N77-26545# Oak Ridge National Lab., Tenn.
MATERIALS APPLICATIONS AND MATHEMATICAL PROPERTIES OF THE RATIONAL POLYNOMIAL CREEP EQUATION
D. O. Hobson Dec. 1976 28 p refs
(Contract W-7405-eng-26)
(ORNL-5202) Avail: NTIS HC A03/MF A01

The analytical properties of the equation, which contribute

to its great simplicity and flexibility in use, are described. Also, the applications of the equation to individual materials are briefly reviewed. ERA

N77-26546# Oak Ridge National Lab., Tenn. Reactor Div.
DEVELOPMENT OF SIMPLIFIED ANALYSIS METHODS FOR RATCHETTING AND CREEP FATIGUE Status Report
G. T. Yahr and W. K. Sartory 1976 26 p refs Presented at the Ann. Meeting of the Am. Soc. of Mech. Engr., New York, 29 Nov. 1976
(Contract W-7405-eng-26)
(CONF-761107-6) Avail: NTIS HC A03/MF A01

The results from analyses of nine two-dimensional axisymmetric cases, which include notched cylindrical shells, a built-in cylindrical shell, and cylindrical shells with axial variations in temperature, pressure, and/or wall thickness, are discussed. Stresses are produced by cyclic temperatures, internal pressure, and axial loads. Simplified analysis methods that will produce conservative predictions of ratchetting and creep-fatigue for these problems are discussed. ERA

N77-26547# Nederlandse Scheeps-Studiecentrum TNO, Delft. Shipbuilding Dept.
BUCKLING ANALYSIS OF SHIP PLATE-STRUCTURES
I. H. Geertsema (Inst. for Mech. Construct. TNO) Sep. 1976 27 p refs
(Rept-207-S; TDCK-68734) Avail: NTIS HC A03/MF A01

The finite element method and the NASTRAN program were used to compute buckling loads for some typical examples of ship-plating. Results show good agreement with those obtained with a simplified buckling analysis. In addition, a linearized large deflection analysis was performed for a plate structure loaded by a combination of in-plane and normal pressure. This analysis demonstrates the gradual growth of the deflections due to the normal pressure until at a certain load-level the buckling mode becomes dominant. Author (ESA)

N77-26548# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost.
EXOSAT THERMAL DISTORSIONS
C. Blaas 19 Jul. 1976 42 p refs
(FOK-RV-76-56) Avail: NTIS HC A03/MF A01

Using the CDC-STARDYNE program a finite-element analysis was made of the thermal distorsions of the Exosat structure. The model, its properties, and the way themal data input is realized are described. For eight thermal cases the deflections of the structure are computed for both aluminum and CFRP (carbon fiber reinforced plastics) faces for the equipment platform sandwich. Author (ESA)

N77-26549# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
STRUCTURAL ANALYSIS OF A WING PART USING THE ASKA PROGRAM SYSTEM [DE STERKTEBEREKENING AAN EEN VLEUGELDEEL MET BEHULP VAN HET ASKA PROGRAMMASYSTEEM]
C. J. Lof and H. H. Ottens Feb. 1977 23 p In DUTCH Sponsored by Neth. Organ. for Aerospace Programmes (NIVR)
(NLR-TR-73030-U) Avail: NTIS HC A02/MF A01

A computation was carried out for a part of the F-28 wing, using the ASKA program, a computer program for structural analysis. The initiation of loads from the nose flaps in the wing was investigated. Results are compared with those of calculation previously carried out. The accuracy, computing time, and costs are considered. ESA

N77-26550# Oxford Univ. (England). Dept. of Engineering Science.
FAILURE ANALYSIS OF PRESSURE VESSELS WITH DEFECTS Progress Report, Sep. 1976
P. H. Hodkinson Sep. 1976 25 p refs
(OUEL-1168/76) Avail: NTIS HC A02/MF A01

Results obtained from tests performed since 1974 on plate specimens of maraging steel are summarized. These results show the effects of thickness on the fracture toughness and slow crack growth characteristics of the steel and indicate that, from the point of view of design, Dowling and Townley's two-criteria approach to failure is valid provided due allowance is made for slow crack growth. Author (ESA)

N77-26551# Bari Univ. (Italy). Ist. di Costruzione di Macchine.
FIRST REPORT ON CAPABILITIES OF DYNAMIC STRUCTURAL ANALYSIS BY THE STRUDL PROGRAM [PRIMO RAPPORTO SULLE CAPACITA DI ANALISI DINAMICA DELLO STRUDL]
Bruno Atzori and Franco Fresa Oct. 1976 18 p refs In ITALIAN; ENGLISH summary
(Rept-76-2) Avail: NTIS HC A02/MF A01

The capabilities of dynamic structural analysis by the STRUDL 2 program were studied. The case of frame analysis was examined for checking the validity of the results. Several factors, such as the influence of the number of elements on the approximation of the results and the CPU time necessary to solve some typical cases, were also investigated. Author (ESA)

N77-26552# Bari Univ. (Italy). Ist. di Costruzione di Macchine.
FATIGUE RESISTANCE OF WELDED JOINTS IN AlMg5 SUBJECTED TO BENDING [RESISTENZA A FATICA DI GIUNTI SALDATI IN AlMg5 SOLLECITATI A FLESSIONE]
B. Atzori [1976] 11 p refs In ITALIAN
Avail: NTIS HC A02/MF A01

The bending behavior of several types of welded joints was investigated in order to determine their fatigue resistance characteristics. The materials examined were alloys of aluminum and magnesium with percentages of Mg between 3 and 5.5. A comparison was made between these results and those obtained for axial loading tests, previously carried out. ESA

N77-26553# Bari Univ. (Italy). Ist. di Costruzione di Macchine.
PARAMETRIC ANALYSIS OF THE STRESSES IN A CRUCIFORM AXIALLY LOADED WELDED JOINT [ANALISI PARAMETRICA DELLE SOLLECITAZIONI IN UN GIUNTO SALDATO A CROCE SOLLECITATO ASSIALMENTE]
Bruno Atzori and Vito Dattoma Nov. 1976 23 p refs In ITALIAN; ENGLISH summary
(Rept-76-3) Avail: NTIS HC A02/MF A01

The influence of the geometry on the stresses present in a cruciform welded joint axially loaded was investigated. Complete penetration was assumed for the analysis and the state of stress at the surface of the main plate, especially at the weld-toe, was considered. The analysis was performed using the finite-element technique, with an isoparametric quadrangular element. The computations were carried out on a IBM 370-158. Only two values of the notch radius between welding and main plate were considered. Obtained results are compared with those available in the literature. Author (ESA)

N77-26554# Bari Univ. (Italy). Ist. Costruzione di Macchine.
DATA ON THE FATIGUE RESISTANCE OF WELDED JOINTS Al Mg5, VOLUME 1 [RACCOLTA DI DATI SULLA RESISTENZA A FATICA DEI GIUNTI SALDATI IN Al Mg5]
Bruno Atzori and Raffaele Bufano Nov. 1976 173 p refs In ITALIAN; ENGLISH summary 2 Vol.
(Rept-76-4-Vol-1) Avail: NTIS HC A08/MF A01

A collection of S-N curves for welded joints in aluminum alloys containing from 3% to 5.5% of magnesium is presented. The series of experimental results taken from the literature are reported in tables and diagrams in a unified manner. The data are reanalyzed using a new statistical procedure, developed in a previous work, which makes it easy to compare the various series and to apply the results to practical cases. The basis of the procedure is the hypothesis that a constant scatter-band holds for different kinds of joints in the same material. Data obtained with bending loading and, in particular, testing conditions are also included in the collection. Author (ESA)

N77-26555# Bari Univ. (Italy). Ist. di Costruzione di Macchine.
FATIGUE BEHAVIOR OF WELDED JOINTS IN Al Zn Mg1, Al Zn4 Mg1, AND Al Mg Si (TABLES AND DIAGRAMS) [COMPORTAMENTO A FATICA DEI GIUNTI SALDATI IN Al Zn Mg1, Al Zn4 Mg1 ED Al Mg Si (TABELLE E DIAGRAMMI)]

Bruno Atzori and Pasquale Indrio Dec. 1976 217 p refs In ITALIAN; ENGLISH summary 2 Vol.
(Rept-76-5-Vol-2) Avail: NTIS HC A10/MF A01

A series of experimental results on the fatigue life of welded joints are reported in a uniform manner. The main purpose of the collection was to check the applicability of a uniform scatter-band previously determined for Al Mg5 to different kinds of aluminum alloys. Author (ESA)

N77-26556# Bristol Univ. (England). Dept. of Aeronautical Engineering.

THE ANALYSIS OF REINFORCED HOLES IN CARBON FIBRE PLATES Ph.D. Thesis

Donald Olafur McKenzie Feb. 1976 221 p refs Sponsored by Sci. Res. Council
Avail: NTIS HC A10/MF A01

The effect of a particular method for the reinforcement of holes in plates by the use of hoop-wound carbon fiber reinforcing disks was investigated. Stresses and strains around the holes and the failure loads of the plates were examined for conditions of uniform tension and loads applied through the hole. An analytical solution is presented for reinforced infinite isotropic plates subjected to uniform tension, but for orthotropic carbon fiber plates the finite element displacement method of analysis is used. The hoop-wound disks were found to be effective in reducing the stresses around the holes, with the principal stresses being taken by the strong fibers. Using hoop-wound reinforcements of a reasonable size the stresses in isotropic plates can be returned to the uniform applied stress, and in carbon fiber plates the stress concentrations can be cut by two thirds. The plates and reinforcing disks were manufactured and uniform loads were applied. Strain gage measurements were compared with theoretical predictions. There is reasonable agreement for the uniform tension cases, but results for the reinforced bolt loaded holes do not correlate as well with theory. A distorsional energy failure criterion predicts the reinforced carbon fiber plates suffer initial damage away from the position of maximum stress, though experimental testing of the plates to failure does not confirm this. Author (ESA)

N77-26557# Bristol Univ. (England). Dept. of Civil Engineering.

THE THEORETICAL AND EXPERIMENTAL DYNAMIC ANALYSIS OF THIN SHELLS OF REVOLUTION Ph.D. Thesis

Halil Karadeniz May 1976 288 p refs Sponsored in part by Karadeniz Tech. Univ. and UNESCO
Avail: NTIS HC A13/MF A01

The finite element method was used to study the static and dynamic behavior of axisymmetric thin shells in air, containing liquids, or submerged in water. A meridionally curved axisymmetric thin shell element was developed. The exact shape of the meridional curve for practically used shells of revolution, and two kinds of displacement functions (cubic and quintic), were used in the element derivation. A junction problem produced by geometrically discontinuous shells of revolution was also tackled, and a technique of solution is proposed. A finite element computer program is described, and the user guide to data preparation is explained. Author (ESA)

N77-26558# California State Dept. of Transportation, Sacramento. Transportation Lab.

PRECISION OF SELECTED CONCRETE TEST METHODS Interim Report

P. E. Benson and C. R. Sundquist Nov. 1976 50 p refs
(PB-263550/6; FHWA-RD-M-0341) Avail: NTIS HC A03/MF A01 CSCL 13C

Precision statements for the following Portland cement concrete test methods are presented: compressive strength, flexural strength, unit weight, air content, and ball penetration. Testing programs and analytical methods are described in detail. Analytical techniques used include analysis of variance, randomized block, latin square, and least squares regression. Also presented are analyses and discussions on the following related subjects: Prediction of flexural strength from compressive strength; use of the air meter base for determining unit weight; use of the K-Meter for measuring concrete consistency; and precision of the cement factor determination. GRA

N77-26559# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Composite and Fibrous Materials Branch.

DAMAGE TOLERANCE OF THIN SKIN SANDWICH PANELS Final Report, Apr. - Sep. 1976

Andrew E. Steinmann Feb. 1977 33 p refs
(AD-A037526; AFML-TR-76-185) Avail: NTIS HC A03/MF A01 CSCL 01/3

An instrumented test procedure for low energy impact tolerance of thin skin sandwich panels was developed. Damage modes of this test were shown to correlate on a one-to-one basis with actual falling ball tests. Basic parameters of core density, cell size, skin thickness, and fiber orientation were examined, and results useful to designing of sandwich panels are discussed. Author (GRA)

N77-26560# Texas Transportation Inst., College Station.

EFFECTS OF PAVEMENT GROOVING ON FRICTION, BRAKING, AND VEHICLE CONTROL Final Report, 31 Dec. 1973 - 16 May 1976

J. E. Martinez, R. D. Young, and W. C. Faatz Mar. 1976 194 p refs
(Contract DOT-FH-11-8267)
(PB-264665/1; FHWA-RD-76-166) Avail: NTIS HC A09/MF A01 CSCL 13B

A comprehensive literature review and laboratory and full-scale tests were performed to develop mathematical models that would predict the effects of pavement grooving on friction, braking, and vehicle control. The mathematical models predict the response of automobiles, motorcycles and articulated vehicles. Based upon the test motorcycle, rider evaluation demonstrates a perceptible difference between traffic-worn and unworn grooving and the effect becomes more pronounced at higher speeds. Based upon computer simulation of a medium weight vehicle, the effect of grooving is more beneficial for lower friction than high friction pavements. GRA

N77-26561# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.

RELIABILITY STUDY OF SINGER. VOLUME 1: VALIDATION OF MODEL Final Report

S. M. Holzer, A. E. Somers, and Joel C. Bradshaw, III Jan. 1977 94 p refs Sponsored in part by DNA
(Contract F29601-75-C-0050)
(AD-A037819; AFWL-TR-76-192-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 13/13

The first volume of the report is connected with the refinement and the demonstration of the current capability of the computer code SINGER. The function of SINGER is to predict the complete response (including element failures and structural collapse) of skeletal reinforced concrete structures to static and dynamic loads. The refinement of SINGER comprises the following principal tasks: The validation of the finite element, the selection of an appropriate quadrature method, and the formulation of error controls, in energy evaluations. In the validation effort, the performance of the finite element (and assemblages of the element) is tested over the entire range of response, from the elastic geometrically linear range to the inelastic geometrically nonlinear range. The validation is based on two continuum models of elastic and inelastic beam-columns, which admit closed-form solutions. A literature survey indicated that the Gaussian quadrature is the most appropriate quadrature errors. The selection is based on convergence characteristics and error estimates. Energy computations involve discretization and quadrature errors. Accordingly, error measures are proposed to control the accuracy of the response predictions. A variety of problems is solved and compared to independent numerical ad experimental solutions to illustrate the current capability of SINGER. Author (GRA)

N77-26562# Polytechnic Inst. of New York, Brooklyn. Dept. of Aerospace Engineering and Applied Mechanics.

STATIC AND DYNAMIC BEHAVIOR OF NONCIRCULAR CYLINDRICAL SHELLS Annual Interim Report, 1 Jan. - 31 Dec. 1976

Joseph Kempner Dec. 1976 9 p refs
(Contract F44620-74-C-0047; AF Proj. 9782)

(AD-A037673; AFOSR-77-0192TR) Avail: NTIS HC A02/MF A01 CSCL 13/13

During the past contract period the primary effort on this research program has been concerned with the buckling, postbuckling and vibrations of oval cylindrical shells and rings. Both analytical and experimental projects were undertaken. The work included linear as well as nonlinear analyses, and consideration of unreinforced and reinforced shells, as well as oval rings.
Author (GRA)

N77-26563# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.

APPLICATION OF HYBRID FINITE ELEMENTS TO STRUCTURE MECHANICS PROBLEMS Final Report, 1 Dec. 1972 - 30 Sep. 1976

Theodore H. H. Pian Jan. 1977 73 p refs
(Contract F44620-72-C-0018; AF Proj. 9782)
(AD-A038016; ASRL-TR-170-5; AFOSR-TR-77-0209) Avail: NTIS HC A04/MF A01 CSCL 13/13

This report presents a summary of the results of this research program. A list of all publications under this contract is given. The research findings summarized here are listed under four categories: (1) rationalization and extensions of variational formulations of finite element methods, (2) development of crack elements, (3) analysis of geometrically nonlinear problems, and (4) analysis of material nonlinear problems. Two appendices which contain more detailed descriptions are (A) Creep and viscoplastic analysis by assumed stress hybrid finite elements and (B) Three-dimensional crack elements by hybrid stress model.
Author (GRA)

N77-26564# Dayton Univ. Research Inst., Ohio.

STABILITY OF FLAT, CLAMPED, RECTANGULAR SANDWICH PANELS SUBJECTED TO COMBINED INPLANE LOADINGS Final Report, May 1975 - May 1976

Carl S. King Dec. 1976 77 p refs
(Contract F33615-75-C-3009; AF Proj. 1368)
(AD-A037489; UDRI-TR-76-59; AFFDL-TR-76-137) Avail: NTIS HC A05/MF A01 CSCL 13/13

The general stability of flat, rectangular sandwich panels loaded by combined biaxial compression, biaxial edgewise bending and edgewise shear is investigated. The analysis is applicable to sandwich structures having isotropic face sheets and orthotropic cores. The analysis procedure is based upon a linear potential energy formulation and the Ritz method of discretization. For the case of clamped boundaries, it is shown that the equation of the potential energy must be minimized by the use of matrices. The analysis leads to an infinite series solution for which the eigenvalues of the equation of matrices are monotonically decreasing. This analysis is presented in detail with the equations for the potential energy presented in three Appendices. The equation presented in Appendix C is the expression used to minimize the potential energy of a flat, clamped sandwich panel.
Author (GRA)

N77-26565# Virginia Univ., Charlottesville. Dept. of Mechanical Engineering.

TRANSIENT RESPONSE OF CONTINUOUS ELASTIC STRUCTURES

W. Pilkey Feb. 1977 76 p refs
(Contract N00014-75-C-0374)
(AD-A037001; UVA/525303/ME77/101) Avail: NTIS HC A05/MF A01 CSCL 13/13

A general theory for the dynamic response of linear damped continuous structured members is formulated with a modal analysis. The theory applies to elastic or viscoelastic solids. Proportional and non-proportional damping are included.
Author (GRA)

N77-26566# Watervliet Arsenal, N.Y.

THE STABILITY OF A BEAM SUBJECTED TO A MOVING MASS

G. L. Anderson Feb. 1977 23 p refs
(DA Proj. 1T1-61102-B-14A)
(AD-A037719; WVT-TR-77006) Avail: NTIS HC A02/MF A01 CSCL 20/11

The parametric stability of a slender, elastic simply supported beam subjected to the action of a concentrated mass moving at constant velocity along its axis is investigated. The Galerkin procedure is applied to reduce the partial differential equation of motion to an ordinary differential equation in time with periodic coefficients. A perturbation procedure is employed to solve this differential equation, and the boundary curves of the fundamental region of instability are determined.
Author (GRA)

42 GEOSCIENCES (GENERAL)

N77-26567*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE SPECTRUM OF THE GEOID FROM ALTIMETER DATA

C. A. Wagner Apr. 1977 121 p refs Submitted for publication
(NASA-TM-X-71337; X-921-77-63) Avail: NTIS HC A06/MF A01 CSCL 08E

A variety of sources of detailed information has been analyzed to arrive at a geoid power spectrum from global altimeter data. Using the equivalent of only two revolutions of data (mostly from GEOS-3) from all the major oceans, the high frequency geoid power (rms) is estimated (most simply) to be 80.7 n to the minus 1.47th power meters, where n is in cycles/global revolutions. This law is valid for all frequencies above 19 cycles but includes sea state. The (simple) law has more power than predicted by Kaula's rule for the geopotential. However, the data shows significantly less power for frequencies below 100 cycles. A closer approximation to the altimetry accumulates 2.18m (rss) for all frequencies higher than 19 cycles/rev. (including sea state), somewhat less power than predicted by the rule. The data permits up to 1.25 (rms) non-gravitational departures from the high frequency marine geoid.
Author

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N77-26568* Cornell Univ., Ithaca, N.Y.

REMOTE SENSING PROGRAM Semiannual Status Report, 1 Dec. 1976 - 31 May 1977

Ta Liang, Arthur J. McNair, and Warren R. Philipson Jun. 1977 276 p refs
(Grant NGL-33-010-171)
(NASA-CR-153288; SASR-10) Avail: Issuing Activity CSCL 05B

Remotely sensed data obtained by aircraft and satellite were used to assess land suitability for septic tanks, analyze linears for ground water sources, delineate town aquifers, evaluate land for state park development, and assess drainage for an historic building. Projects in progress include environmental analysis of proposed fly ash disposal sites, thermal analysis of building insulation, and an assessment of vineyard-related problems. Spinoff and future projects are briefly described.
A.R.H.

N77-26569*# Comision Nacional del Espacio Exterior, Mexico City (Mexico).

COMPREHENSIVE STUDY OF LEON-QUERETARO AREA

Hector Alonso Espinosa, Humberto Ramos Moreno, Josue Macias Morales, Jorge Olivares Martell, and Ernesto Bribiesca Correa, Principal Investigators 30 Mar. 1977 8 p Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS (E77-10154; NASA-CR-152707; Rept-2) Avail: NTIS HC A02/MF A01 CSCL 08F

There are no author-identified significant results in this report.

N77-26570*# Department of the Northern Territory, Darwin (Australia).
LAND DEVELOPMENT IN THE DALY BASIN Progress Report, Jan. 1977
B. G. Wood, Principal Investigator 18 Jan. 1977 1 p Sponsored by NASA ERTS
(E77-10155; NASA-CR-152709) Avail: NTIS HC A02/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N77-26571*# Department of the Northern Territory, Darwin (Australia).
LAND DEVELOPMENT IN THE DALY BASIN Progress Report
Blair G. Wood, Principal Investigator 4 May 1977 1 p Sponsored by NASA ERTS
(E77-10156; NASA-CR-152710) Avail: NTIS HC A02/MF A01 CSCL 08B
There are no author-identified significant results in this report.

N77-26572*# Utah Univ., Salt Lake City. Dept. of Geology and Geophysics.
APPLICATION OF STANDARD PHOTOGEOLOGIC TECHNIQUES TO LANDSAT IMAGERY FOR MINERAL EXPLORATION IN THE BASIN AND RANGE PROVINCE OF UTAH AND NEVADA Final Report
Laurence H. Lattman, Principal Investigator Jun. 1977 243 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-20955)
(E77-10170; NASA-CR-153229) Avail: NTIS HC A11/MF A01 CSCL 08G
The author has identified the following significant results. Standard photogeologic techniques were applied to LANDSAT imagery of the basin and range province of Utah and Nevada to relate linear, tonal, textural, drainage, and geomorphic features to known mineralized areas in an attempt to develop criteria for the location of mineral deposits. No consistent correlation was found between lineaments, mapped according to specified criteria, and locations of mines, mining districts, or intrusive outcrops. Tonal and textural patterns were more closely related to geologic outcrop patterns than to mineralization. A statistical study of drainage azimuths of various length classes as measured on LANDSAT showed significant correlation with mineralized districts in the length class of 3-6 km. Alignments of outcrops of basalt, a rock type highly visible on LANDSAT imagery, appear to be colinear with acidic and intermediate intrusive centers in some areas and may assist on the recognition of regional fracture systems for mineral exploration.

N77-26573*# Instituto Geofisico del Peru, Lima.
APPLICATION OF REMOTE SENSING TECHNIQUES FOR THE STUDY AND EVALUATION OF NATURAL RESOURCES IN PERU Progress Report
Jose Pomalaza, Principal Investigator [1976] 5 p Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E77-10171; NASA-CR-153227) Avail: NTIS HC A02/MF A01 CSCL 08F
There are no author-identified significant results in this report.

N77-26574*# Instituto Geofisico del Peru, Lima.
APPLICATION OF REMOTE SENSING TECHNIQUES FOR THE STUDY AND EVALUATION OF NATURAL RESOURCES IN PERU Progress Report
Jose Pomalaza, Principal Investigator [1976] 5 p Sponsored by NASA ERTS
(E77-10172; NASA-CR-153228) Avail: NTIS HC A02/MF A01 CSCL 08F
There are no author-identified significant results in this report.

N77-26575*# Delaware Univ., Newark. Center for Remote Sensing.
APPLICATION OF LANDSAT-2 TO THE MANAGEMENT OF DELAWARE'S MARINE AND WETLAND RESOURCES Progress Report, Apr. - Jun. 1977
V. Klemas, Principal Investigator, D. Bartlett, W. Philpot, and G. Davis 15 Jun. 1977 5 p refs ERTS
(Contract NAS5-20983)
(E77-10173; NASA-CR-153211) Avail: NTIS HC A02/MF A01 CSCL 08C
There are no author-identified significant results in this report.

N77-26576*# Texas Univ., Austin.
DEVELOPMENT AND APPLICATION OF OPERATIONAL TECHNIQUES FOR THE INVENTORY AND MONITORING OF RESOURCES AND USES FOR THE TEXAS COASTAL ZONE Quarterly Report, Jun. 1976 - Feb. 1977
Peggy Harwood, Principal Investigator (General Land Office, Austin, Tex.), Patricia Malin (General Land Office, Austin, Tex.), Robert Finley, Samuel McCulloch, David Murphy, Bill Hupp, and John A. Schell (Texas A and M Univ., College Station) May 1977 101 p refs ERTS
(Contract NAS5-20986)
(E77-10174; NASA-CR-153262) Avail: NTIS HC A06/MF A01 CSCL 05A
The author has identified the following significant results. Four LANDSAT scenes were analyzed for the Harbor Island area test sites to produce land cover and land use maps using both image interpretation and computer-assisted techniques. When evaluated against aerial photography, the mean accuracy for three scenes was 84% for the image interpretation product and 62% for the computer-assisted classification maps. Analysis of the fourth scene was not completed using the image interpretation technique, because of poor quality, false color composite, but was available from the computer technique. Preliminary results indicate that these LANDSAT products can be applied to a variety of planning and management activities in the Texas coastal zone.

N77-26577*# Stanford Research Inst., Menlo Park, Calif.
MICROWAVE PROPERTIES OF ICE FROM THE GREAT LAKES Final Report
R. S. Vickers Jan. 1975 36 p refs
(Contract NAS3-19092; SRI Proj. 3571)
(NASA-CR-135222) Avail: NTIS HC A03/MF A01 CSCL 08L
The increasing use of radar systems as remote sensors of ice thickness has revealed a lack of basic data on the microwave properties of fresh-water ice. A program, in which the complex dielectric constant was measured for a series of ice samples taken from the Great Lakes, is described. The measurements were taken at temperatures of -5, -10, and -15 C. It is noted that the ice has considerable internal layered structure, and the effects of the layering are examined. Values of 3.0 to 3.2 are reported for the real part of the dielectric constant, with an error bar of + or - 0.01. Author

N77-26578*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
REMOTE SENSING IN MICHIGAN FOR LAND RESOURCE MANAGEMENT Final Report, 1 Jun. 1972 - 31 May 1977
I. J. Sattinger, L. B. Istvan, N. E. G. Roller, and D. S. Lowe May 1977 81 p refs
(Grant NGR-23-005-552)
(NASA-CR-153392; ERIM-193400-16-F) Avail: NTIS HC A05/MF A01 CSCL 05A
An extensive program was conducted to establish practical uses of NASA earth resource survey technology in meeting resource management problems throughout Michigan. As a result, a broad interest in and understanding of the usefulness of remote sensing methods was developed and a wide variety of applications was undertaken to provide information needed for informed decision making and effective action. Author

N77-26579*# Texas A&M Univ., College Station. Remote Sensing Center.
DEMONSTRATION TO CHARACTERIZE WATERSHED

RUNOFF POTENTIAL BY MICROWAVE TECHNIQUES Final Report
Bruce J. Blanchard 1 Jun. 1977 37 p refs
(Contract NAS9-14898)
(NASA-CR-151426; RSC-3345) Avail: NTIS HC A03/MF A01 CSCL 08H

Characteristics such as storage capacity of the soil, volume of storage in vegetative matter, and volume of storage available in local depressions are expressed in empirical watershed runoff equations as one or more coefficients. Conventional techniques for estimating coefficients representing the spatial distribution of these characteristics over a watershed drainage area are subjective and produce significant errors. Characteristics of the wear surface are described as a single coefficient called the curve number.
Author

N77-26580*# Kansas State Univ., Manhattan. Evapotranspiration Lab.
ESTIMATED WINTER WHEAT YIELD FROM CROP GROWTH PREDICTED BY LANDSAT Final Report, Mar. 1976 - Mar. 1977
Edward T. Kanemasu May 1977 181 p refs
(Contract NAS9-14899)
(NASA-CR-151431) Avail: NTIS HC A09/MF A01 CSCL 02C

An evapotranspiration and growth model for winter wheat is reported. The inputs are daily solar radiation, maximum temperature, minimum temperature, precipitation/irrigation and leaf area index. The meteorological data were obtained from National Weather Service while LAI was obtained from LANDSAT multispectral scanner. The output provides daily estimates of potential evapotranspiration, transpiration, evaporation, soil moisture (50 cm depth), percentage depletion, net photosynthesis and dry matter production. Winter wheat yields are correlated with transpiration and dry matter accumulation. Author

N77-26581*# Kentucky Univ. Research Foundation, Lexington. Dept. of Forestry.
REMOTE SENSING OF EFFECTS OF LAND USE PRACTICES ON WATER QUALITY Final Report, 11 Oct. 1974 - 31 May 1977
Donald H. Graves and George B. Colthrap 31 May 1977 170 p refs
(Contract NAS8-31006)
(NASA-CR-150306) Avail: NTIS HC A08/MF A01 CSCL 08H

An intensive study was conducted to determine the utility of manual densitometry and color additive viewing of aircraft and LANDSAT transparencies for monitoring land use and land use change. The relationship between land use and selected water quality parameters was also evaluated. Six watersheds located in the Cumberland Plateau region of eastern Kentucky comprised the study area for the project. Land uses present within the study area were reclaimed surface mining and forestry. Fertilization of one of the forested watersheds also occurred during the study period. Author

N77-26582*# Operations Research, Inc., Silver Spring, Md.
AGRICULTURE AVIATION STUDY AND PROGRAM PLAN. VOLUME 1: PROJECT SUMMARY Final Report
6 Jun. 1976 51 p 2 Vol.
(Contract NASw-2880)
(NASA-CR-153283) Avail: NTIS HC A04/MF A01 CSCL 02C

An assessment of the impact of agricultural aviation on agricultural productivity, and the technology needs of agricultural aviation are presented. Author

N77-26583*# Operations Research, Inc., Silver Spring, Md.
AGRICULTURE AVIATION STUDY AND PROGRAM PLAN. VOLUME 2: SUPPLEMENTAL INFORMATION Final Report
9 Jun. 1976 74 p 2 Vol.
(Contract NASw-2880)
(NASA-CR-153284) Avail: NTIS HC A04/MF A01 CSCL 02C

For abstract, see N77-26582.

N77-26584*# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
THE USE OF REMOTE SENSING IN SOLVING FLORIDA'S GEOLOGICAL AND COASTAL ENGINEERING PROBLEMS Status Report, 1 Jul. 1976 - 31 Mar. 1977
H. K. Brooks, B. E. Ruth, Y. H. Wang, and R. L. Ferguson (General Electric, Daytona Beach, Fla.) 31 Mar. 1977 28 p refs Original contains color illustrations
(Grant NsG-7236)
(NASA-CR-153286; SR-1) Avail: NTIS HC A03/MF A01 CSCL 08C

LANDSAT imagery and NASA high altitude color infrared (CIR) photography were used to select suitable sites for sanitary landfill in Volusia County, Florida and to develop techniques for preventing sand deposits in the Clearwater inlet. Activities described include the acquisition of imagery, its analysis by the IMAGE 100 system, conventional photointerpretation, evaluation of existing data sources (vegetation, soil, and ground water maps), site investigations for ground truth, and preparation of displays for reports. Author

N77-26585*# Virginia Inst. of Marine Science, Gloucester Point.
APPLICATIONS OF REMOTE SENSING TO ESTUARINE MANAGEMENT Annual Report
John C. Munday, Jr., Hayden H. Gordon, and Harold F. Hennigar Jun. 1977 74 p refs
(Grant NGL-47-022-005)
(NASA-CR-153287; AR-5) Avail: NTIS HC A04/MF A01 CSCL 05A

Remote sensing was used in the resolution of estuarine problems facing federal and Virginia governmental agencies. A prototype Elizabeth River Surface Circulation Atlas was produced from photogrammetry to aid in oil spill cleanup and source identification. Aerial photo analysis twice led to selection of alternative plans for dredging and spoil disposal which minimized marsh damage. Marsh loss due to a mud wave from a highway dyke was measured on sequential aerial photographs. An historical aerial photographic sequence gave basis to a potential Commonwealth of Virginia legal claim to accreting and migrating coastal islands. Author

N77-26586*# Mississippi State Univ., Mississippi State.
APPLICATION OF REMOTE SENSING TO STATE AND REGIONAL PROGRAMS Semiannual Progress Report, 1 Nov. 1976 - 30 Apr. 1977
W. Frank Miller, Bradley D. Carter, David E. Pettry, and Gary K. Higgs 1 May 1977 149 p
(Grant NGL-25-001-054)
(NASA-CR-153279; SAPR-7) Avail: NTIS HC A07/MF A01 CSCL 05A

The problem includes data acquisition and transformation to products acceptable to the users. Optimized institutionalization of data management, product transfer, and education of the user community are also of major concern. With respect to the lattice, various structures were suggested and the fields of application are presented. Author

N77-26587*# Florida Univ., Gainesville. Dept. of Geology.
BASIC HYDROGEOLOGIC AND REMOTE SENSING DATA FOR SELECTION OF SANITARY LANDFILL SITES
H. K. Brooks, B. E. Ruth, and J. D. Degner 5 Apr. 1977 28 p refs
(Grant NsG-7236)
(NASA-CR-153280; UFL/COEL-77/002; Rept-1) Avail: NTIS HC A03/MF A01 CSCL 08G

Solid waste disposal were studied in Volusia County to protect the water supply in the area. Highlands in this County are of limited areal extent and, most significantly, the sand hills and ridges are in areas where recharge of the Floridan aquifer occurs. This study proves that well drained soils meeting the current State requirements are of limited areal extent. These areas should not be utilized as sanitary landfill sites! Rather, it is recommended that the Tomoka Farm Road site into the adjacent wetlands be extended. The County site on Rima Ridge recommended by Greenleaf-Telesca as the primary waste burial site in the County should be re-evaluated because of potential danger to the Daytona Beach water supply. Author

N77-26588*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
REMOTE SENSING OF WETLANDS
Norman E. G. Roller Mar. 1977 165 p refs
(Grant NGR-23-005-522)
(NASA-CR-153282; ERIM-193400-14-T) Avail: NTIS HC A08/MF A01 CSCL 14E

The concept of using remote sensing to inventory wetlands and the related topics of proper inventory design and data collection are discussed. The material presented shows that aerial photography is the form of remote sensing from which the greatest amount of wetlands information can be derived. For extensive, general-purpose wetlands inventories, however, the use of LANDSAT data may be more cost-effective. Airborne multispectral scanners and radar are, in the main, too expensive to use - unless the information that these sensors alone can gather remotely is absolutely required. Multistage sampling employing space and high altitude remote sensing data in the initial stages appears to be an efficient survey strategy for gathering non-point specific wetlands inventory data over large areas. The operational role of remote sensing insupplying inventory data for application to several typical wetlands management problems is illustrated by summary descriptions of past ERIM projects. Author

N77-26589*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LACIE: A LOOK TO THE FUTURE
R. B. MacDonald and F. G. Hall 29 Apr. 1977 38 p refs Presented at 11th Intern. Symp. on Remote Sensing of Environ., Ann Arbor, Mich., 25-29 Apr. 1977
(NASA-TM-74623; JSC-11685) Avail: NTIS HC A03/MF A01 CSCL 08B

The Large Area Crop Inventory Experiment (LACIE) is described. The experiment's approach to production monitoring is described briefly, and its status is reviewed as of the conclusion of 2 years of successful operation. Examples of acreage and yield monitoring in the Soviet Union are used to illustrate the experiment's approach. Author

N77-26590*# Lockheed Electronics Co., Houston, Tex.
ADVANCED SENSORS AND APPLICATIONS STUDY (ASAS)
S. B. Chism and C. L. Hughes Nov. 1976 353 p refs
(Contract NAS9-12200)
(NASA-CR-151441; LEC-7790-Rev-A; JSC-10975) Avail: NTIS HC A16/MF A01 CSCL 14B

The present EOD requirements for sensors in the space shuttle era are reported with emphasis on those applications which were deemed important enough to warrant separate sections. The application areas developed are: (1) agriculture; (2) atmospheric corrections; (3) cartography; (4) coastal studies; (5) forestry; (6) geology; (7) hydrology; (8) land use; (9) oceanography; and (10) soil moisture. For each application area. The following aspects were covered: (1) specific goals and techniques, (2) individual sensor requirements including types, bands, resolution, etc.; (3) definition of mission requirements, type orbits, coverages, etc.; and (4) discussion of anticipated problem areas and solutions. The remote sensors required for these application areas include; (1) camera systems; (2) multispectral scanners; (3) microwave scatterometers; (4) synthetic aperture radars; (5) microwave radiometers; and (6) vidicons. The emphasis in the remote sensor area was on the evaluation of present technology implications about future systems. Author

N77-26591# Naval Oceanographic Office, Washington, D. C.
AERIAL ICE RECONNAISSANCE AND SATELLITE ICE INFORMATION MICROFILM FILE
Peter A. Mitchell Aug. 1976 39 p refs
(AD-A037300; NOO-RP-17) Avail: NTIS HC A03/MF A01 CSCL 08/12

Interest in the polar regions has increased manyfold in recent years principally due to the newly developing economic incentives and revived military significance of the Arctic and the continuing scientific research in the Antarctic. Improvement and further development of operational sea ice forecasting techniques that allow our naval forces to operate safely in these areas depend heavily upon the maintenance of historical ice data files. The Aerial Ice Reconnaissance and Satellite Ice Information Microfilm File effectively substitutes for the terminated Oceanographic Office annual reports of the Arctic and Antarctic ice observing and forecasting programs. This publication provides the researcher with listings of available microfilm in one of the Navy's more extensive ice data files and describes the procedures to follow to obtain copies of the original chart analyses of aerial ice reconnaissance and satellite ice data. Author (GRA)

N77-26592*# Prairie View Agricultural and Mechanical Coll., Tex.
MEASUREMENT OF GROWTH, MEASUREMENT AND BIDIRECTORAL SCATTERING PARAMETERS OF WHEAT Final Report
Jan. 1977 28 p
(Grant NsG-9006)
(NASA-CR-151351) Avail: NTIS HC A03/MF A01 CSCL 02C

This project was conducted to measure ambient air temperatures at standard 2 meter heights and surface radiative temperatures (thermal infrared radiation) over a maturing winter wheat canopy and bare sandy soil. The purpose of the project was to relate ground truth measurements to satellite derived surface radiative temperatures. The goal was to develop models from which satellite-derived measurements could be used to predict wheat growth patterns and yields. As a corollary advantage, the data for soil moisture and temperature, wind velocity, relative humidity, canopy characteristics and yields were also collected and added to the agronomic data bank used to develop practices which would enhance yields of grain in South Texas. Author

N77-26593*# General Electric Co., Philadelphia, Pa. GE LANDSAT Operations Control Center.
LANDSAT-1 AND LANDSAT-2 FLIGHT EVALUATION REPORT, 23 JULY - 23 OCTOBER 1976
30 Nov. 1976 220 p
(Contract NAS5-21808)
(NASA-CR-152474; Doc-76SDS4278) Avail: NTIS HC A10/MF A01 CSCL 05B

The LANDSAT-1 spacecraft was launched from the Western Test Range on 23 July 1972, at 18:08:06.508Z. The launch and orbital injection phase of the space flight was nominal, and deployment of the spacecraft followed predictions. Performance evaluation of the spacecraft is presented. Author

N77-26594*# General Electric Co., Philadelphia, Pa. LANDSAT Operations Control Center.
LANDSAT-1 AND LANDSAT-2 FLIGHT EVALUATION REPORT Quarterly Report, 23 Jan. - 23 Apr. 1976
14 Jul. 1976 223 p refs
(Contract NAS5-21808)
(NASA-CR-152475; Doc-76SDS4248; QR-16) Avail: NTIS HC A10/MF A01 CSCL 05B

The LANDSAT-1 spacecraft was launched from the Western Test Range on 23 July 1972, at 18:08:06.508Z. The launch and orbital injection phase of the space flight was nominal and deployment of the spacecraft followed predictions. Orbital operations of the spacecraft and payload subsystems were satisfactory through Orbit 147, after which an internal short circuit disabled one of the Wideband Video Tape Recorders (WBVTR-2). Operations resumed until Orbit 196, when the Return Beam Vidicon failed to respond when commanded off. The RBV was commanded off via alternate commands. LANDSAT-1 continued to perform its imaging mission with the Multispectral Scanner and the remaining Wideband Video Tape Recorder providing image data. Author

N77-26595# Brookhaven National Lab., Upton, N.Y. Dept. of Applied Science.
REGIONAL LAND USE AND ENERGY MODELING
A. S. Kydes, J. B. Sanborn, and T. O. Carroll 1976 12 p refs Presented at Intern. Conf. on Cybernetics and Soc., Washington, D. C., 1 Nov. 1976
(Contract E(30-1)-16)
(BNL-21809; Conf-761122-1) Avail: NTIS HC A02/MF A01

The land-use energy-simulation model with the integrated capability for generating energy demand is an extension of the classic Lowry model. Such a model framework described captures two essential features of the land use energy-utilization interaction:

the spatial location of the land use activity is explicit, and transportation energy demand is determined as an integral part of the spatial configuration. The model is divided both conceptually and computationally into three parts: the land use model, a submodel for transportation which provides the work and shop trip distribution for spatial allocation of activities within the land use submodel, and an energy submodel which determines energy demand resulting from the land use configuration. ERA

N77-26596# Netherlands Interdepartmental Working Group on the Application of Remote Sensing, Delft.

ANALYSIS OF SIGNIFICANCE WITHIN CROP-SPECTRA: A COMPARISON STUDY OF DIFFERENT MULTISPECTRAL SCANNERS

J. N. P. Beers May 1975 46 p refs

(NIWARS-Publ-30) Avail: NTIS HC A03/MF A01

In order to study the spectral signatures of vegetation canopies, reflectance data of 11 crops were gathered during the 1973 growing season using the NIWARS double beam type spectrometer. Using the spectra obtained, it was possible to determine for each crop or group of crops the part of the spectrum which is most significant. From this knowledge the use of the channels of different multispectral scanners is concluded in relation to the relative information content of the channels. This information summary leads to quick classification, resulting in a comparison of the multispectral scanners. Author (ESA)

N77-26597# Dornier-System G.m.b.H., Friedrichshafen (West Germany).

MULTIDISCIPLINARY LIDAR SYSTEM IN SPACELAB FOR APPLICATION TO ATMOSPHERIC PHYSICS AND REMOTE SENSING Final Report

Wolfgang Englisch (Battelle Inst.), Eberhard Achtermann, Thorstein Halldorsson (MBB, Ottobrunn, West Ger.), Rasmus Beck (Battelle Inst.), Gerhard Lorch, Wolf Wiesemann (Battelle Inst.), Erhard Wedel, and Guenther Wirths Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1976 314 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-404)

(Contracts BMFT-WRT-1075; DFVLR-BPT-01-QS-405-V23) (BMFT-FB-W-76-23) Avail: NTIS HC A14/MF A01; ZLDI, Munich DM 65.95

Possible applications of a lidar system onboard an airplane or onboard Spacelab were studied. The selection of lasers and detection techniques for the different tasks is discussed and intensity calculations are performed. A combination of an aerosol and a trace gas lidar is proposed for the first Spacelab mission. The aerosol lidar uses pulsed lasers, the trace gas lidar, a CW-CO2-laser and a heterodyne detection technique for the differential absorption method in the IR. The telescope of the Spacelab lidar lies within the 1 m class. An airborne lidar puts minor requirements on its subsystems. It is proposed therefore that this should precede the Spacelab lidar so that experience can be obtained with the technical subsystems, and the scientific benefits can be appraised. Author (ESA)

N77-26598# Groundwater Survey-TNO, Delft (Netherlands).

GEOPHYSICAL WELL LOGGING FOR GEOHYDROLOGICAL PURPOSES IN UNCONSOLIDATED FORMATIONS

F. Walter, ed. 1976 112 p refs

Copyright. Avail: NTIS HC A06/MF A01

Geophysical well logging implies the recording of one or more physical variables which provide information regarding the lithology, stratography, and physico-chemical properties of the liquid filling the pores of a perforated formation. Logging methods of importance to geohydrological investigations are described. These include determination of the spontaneous potential, the formation resistivity, and the natural gamma radiation intensities of the rocks. ESA

N77-26599# World Meteorological Organization, Geneva (Switzerland).

STATISTICAL INFORMATION ON ACTIVITIES IN OPERATIONAL HYDROLOGY

1977 219 p

(WMO-464; OHR-10; ISBN-92-63-10464-6) Avail: NTIS HC A10/MF A01

Statistical information on activities in operational hydrology indicative of the status of progress and future plans of WMO members at national, regional, and global levels is presented. The information given covers international and national organizations dealing with hydrology and water resources; principal river basins; networks of hydrological observing stations; cost and manpower for operation of hydrometric networks; and hydrological data banks. ESA

N77-26600# Helsinki Univ. of Technology, Espoo (Finland). Radio Lab.

MICROWAVE RADIOMETER THEORY AND MEASUREMENTS OF SEA ICE CHARACTERISTICS Project Sea Ice 1975

Martti Tiuri, Martti Hallikainen, and Antti Laaperi 1976 49 p refs Sponsored by the Fin.n-Swed. Board for Winter Navigation Res.

(Rept-S-89; ISBN-951-750-742-9) Avail: NTIS HC A02/MF A01

A project for studying the relation between the physical properties and microwave brightness temperature of sea ice in the Bay of Bothnia in 1975 is described. The results of the experiments and the theory for obtaining the brightness temperature of the sea ice are given. The results indicate that the brightness temperature measured at 600 MHz is related to the thickness of ice. During the experiments the ice temperature was fairly close to the melting point and hence the brightness temperature at 4.7 GHz can be correlated within the ice thickness for thin ice only. For ice ridges the 600 MHz radiometer shows thick ice and the 4.7 GHz radiometer thin ice. This can be employed for detecting ice ridges. The theory predicts that for ice thinner than about 30 cm the brightness temperature oscillates as a function of ice thickness. Hence a radiometer operating on a narrow band-width probably cannot be used for determining the thickness of thin ice. Author (ESA)

N77-26601# Universities Council on Water Resources, Lincoln, Nebr.

WORKSHOP REPORT INTEGRATING WATER QUALITY AND WATER AND LAND RESOURCES PLANNING

1976 361 p refs Conf. proc. held at Pacific Grove, Calif., 11-16 Jan. 1976 Sponsored in part by the US Water Resources Council, EPA, Army Corps of Engineers, and the Depts. of Agriculture and the Interior

(PB-263476/4; OWRT-C-7508(6514)(1); W77-04202) Avail: NTIS HC A16/MF A01 CSCL 13B

Present policies and practices, specifically along the interface among these areas (water quality and water and land resources planning) at local, regional, state, basin and national levels, are evaluated to propose changes and improvements in policies and practices that would enhance cooperation, communication and conflict resolution, and management efficiency, and facilitate more effective impact on the decision-making process considering the limited resources that are and will likely be available to the planning process. GRA

N77-26602# Geological Survey, Menlo Park, Calif. Water Resources Div.

WATER RESOURCES DATA FOR CALIFORNIA, 1975. VOLUME 1: COLORADO RIVER BASIN, SOUTHERN GREAT BASIN FROM MEXICAN BORDER TO MONO LAKE BASIN, AND PACIFIC SLOPE BASINS FROM TIJUANA RIVER TO SANTA MARIA RIVER Annual Report, 1 Oct. 1974 - 30 Sep. 1975

Dec. 1976 563 p Sponsored in part by National Park Service, San Diego City Water Utilities, Bureau of Reclamation, Washington, California State Dept. of Water Resources, Corps of Engineers

(PB-264474/8; USGS/WRD/HD-76/059-Vol-1; USGS/WRD/CA-75/1-Vol-1) Avail: NTIS HC A24/MF A01; also available in set of 4 reports PC E13, PB-264473 CSCL 08H

Volume 1 of water resources data for the 1975 water year for California consists of records of stage, discharge, and water quality of stream; stage, contents, and water quality in lakes and reservoirs; and water levels in wells. It contains discharge records for 248 gaging stations; stage-only record 1 gaging station; stage and contents for 21 lakes and reservoirs; water

quality for 57 stations and 4 wells; water levels for 30 observations wells. GRA

N77-26603# Geological Survey, Menlo Park, Calif. Water Resources Div.
WATER RESOURCES DATA FOR CALIFORNIA, 1975. VOLUME 2: PACIFIC SLOPE BASINS FROM ARROYO GRANDE TO OREGON STATE LINE EXCEPT CENTRAL VALLEY Annual Report, 1 Oct. 1974 - 30 Sep. 1975
Dec. 1976 528 p Sponsored in part by National Park Service, San Diego City Water Utilities Dept., Bureau of Reclamation, Washington, California State Dept. of Water Resources, Corps of Engineers
(PB-264475/5; USGS/WRD/HD-76/058-Vol-2; USGS/WDR/CA-75/2-Vol-2) Avail: NTIS HC A23/MF A01; also available in set of 4 reports PC E13, PB-264473-SET CSCL 08H

Volume 2 of water resources data for the 1975 water year for California consists of records of stage, discharge, and water quality of streams and wells; state, contents, and water quality in lakes and reservoirs; and water levels in wells. It contains discharge records for 150 gaging stations; stage and contents for 20 lakes and reservoirs; water quality for 106 stations and 15 wells, water levels for 27 observation wells. Also included are 17 crest-stage partial-record stations and 2 low-flow partial-record stations. GRA

N77-26604# Geological Survey, Menlo Park, Calif. Water Resources Div.
WATER RESOURCES DATA FOR CALIFORNIA, 1975. VOLUME 3: SOUTHERN CENTRAL VALLEY BASINS AND THE GREAT BASIN FROM WALKER RIVER TO TRUCKEE RIVER Annual Report, 1 Oct. 1974 - 30 Sep. 1975
Dec. 1976 411 p Sponsored in part by National Park Service, San Diego City Water Utilities, California State Water Resources Corps of Engineers
(PB-264476/3; USGS/WRD/HD-74/043-Vol-3; USGS/WDR/CA-75/3-Vol-3) Avail: NTIS HC A18/MF A01; also available in set of 4 reports PC E13, PB-264473-SET CSCL 08H

Volume 3 of water resources data for the 1975 water year for California consists of records of stage, discharge, and water quality of streams; stage, contents, and water quality in lakes and reservoirs; and water levels in wells. It contains discharge records for 188 gaging stations; stage-only records for 1 gaging station; stage and contents for 38 lakes and reservoirs; water quality for 62 stations, and water levels for 15 observation wells. Also included are 31 crest-stage partial-record stations and 13 low-flow partial-record stations. GRA

N77-26605# Geological Survey, Menlo Park, Calif. Water Resources Div.
WATER RESOURCES DATA FOR CALIFORNIA, 1975. VOLUME 4: NORTHERN CENTRAL VALLEY BASINS AND THE GREAT BASIN FROM HONEY LAKE BASIN TO OREGON STATE LINE
Nov. 1976 414 p Sponsored in part by National Park Service, San Diego City Water Utilities Calif., Bureau of Reclamation, Wash., Calif. State Dept. of Water Resources, Corps of Engineers
(PB-264477/1; USGS/WRD/HD-76/044-Vol-4; USGS/WDR/CA-75/4-Vol-4) Avail: NTIS HC A18/MF A01; also available in set of 4 reports PC E13, PB-264473-SET CSCL 08H

Volume 4 of water resources data for the 1975 water year for California consists of records of stage, discharge, and water quality of streams; stage, contents, and water quality in lakes and reservoirs; and water levels in wells. It contains discharge records for 199 gaging stations; stage-only records for 1 gaging station; stage and contents for 30 lakes and reservoirs; water quality for 84 stations, and water levels for 3 observation wells. Also included are 24 crest-stage partial-record stations and 4 low-flow partial-record stations. GRA

N77-26606# Utah Univ., Salt Lake City. Dept. of Geology and Geophysics.
GEOCHEMISTRY AND HYDROTHERMAL ALTERATION AT SELECTED UTAH HOT SPRINGS, VOLUME 3 Final Report
W. T. Parry, Nancy Benson, and Charles D. Miller Jul. 1976 141 p refs
(Grant NSF GI-43741)
(PB-264415/1; NSF/RA-760370-Vol-3) Avail: NTIS HC A07/MF A01 CSCL 08I

Two hot spring areas in differing geological environments have been selected for detailed rock alteration studies. The Monroe-Red Hill area is within an area of Tertiary volcanics and is underlain by a thick Jurassic salt bearing deposit. The Roosevelt area is in Tertiary and Precambrian crystalline rocks. Comparison of rock alteration and water chemistry in these two areas should serve as a model for further exploration and resource characterization in Utah using geochemical techniques. GRA

N77-26607# Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.
DISCRIMINATION OF ALTERNATIVE HYDROLOGIC REGRESSION MODELS: A USER'S MANUAL Final Report
Juan B. Valdes and Ignacio Rodriguez-Iturbe Jul. 1976 117 p refs
(Grant NSF GK-41643)
(PB-264285/8; TN-19; T76-7) Avail: NTIS HC A06/MF A01 CSCL 08H

The listings and documentation of the computer programs used in Valdes and Rodriguez-Iturbe for discrimination of hydrologic regression models are presented. The programs implemented allow the user to discriminate standard regression models, alternative forms of the covariance matrix of the disturbances and competing functional forms. One example is presented for each main program to illustrate the input/output forms. GRA

N77-26608# Naval Surface Weapons Center, Dahlgren, Va.
MAP PROJECTION EQUATIONS Final Report
Frederick Pearson, II Mar. 1977 343 p refs
(AD-A037381; NSWC/DL-TR-3624) Avail: NTIS HC A15/MF A01 CSCL 08/2

Map projection equations in cartesian coordinates are derived for the most important mapping schemes. The important unifying principles of differential geometry are applied to produce the equal area, conformal and conventional projections. This report has collected under one cover the major map projections useful to scientists and engineers. The notation is uniform. The derivations proceed in all cases from first principles to usable equations suitable for hand plotting, digital/analog plotting, or CRT display. The problem is stated, and the reader is introduced to the terminology of the art of map projections. Basic transformation theory is introduced, and then particularized for the transformation from the spheroid or sphere onto a developable surface. The criterion for the derivations is to use the most simple and direct approach. The model of the earth is then considered. The most recent parameters to describe the figure of the earth are given, and tables incorporating these are included for meridian length, parallel length and the relation between geodetic and geocentric latitude. The computer programs which generated these tables are included in the appendix. Equal area, conformal, and conventional projection equations are derived. These equations are incorporated into an original computer program which generated the map plotting tables for the most important projections. This program, which produces either a complete grid or individualized points, is also in the appendix. Since the proof of all of the derivations is a correct graticule of meridians and parallels, original figures of these have been produced. The plotting tables and the figures reflect the modern parameters for the earth. GRA

N77-26609# Naval Weapons Center, China Lake, Calif.
A TECHNIQUE FOR MEASURING OPTICAL LINE OF SIGHT Technical Publication, Jan. - Jul. 1976
Carol J. Burge and Judith H. Lind Jan. 1977 47 p refs
(AD-A037191; NWC-TP-5916) Avail: NTIS HC A03/MF A01 CSCL 08/6

This report is a companion to NWC TP 5908, Line-of-Sight Handbook. Its purpose is to explain how the data were collected and the computations made to produce the data presented in that report. The objective of this masking measurement program is to present probability of line of sight (LOS) as a function of

terrain, range, and altitude. Preparation of the handbook included carrying out a literature search, to determine if the required data existed and, if it did not, if there was a proven technique that could be used to obtain it. Map studies, field studies, and models were examined. Models were rejected for use because their correlation with reality was not known. Information obtained from maps has many advantages, but also limitations--mainly that there is no good way to determine the effects of vegetation on LOS. There were some field data in existence, but information was all gathered for particular sites, with no attempt made to generalize according to types of terrain. However, the literature search did result in discovery of a technique that could be used, with some modification, to obtain desired data on LOS in the field. As a result of the lack of detailed and generalizable information, it was decided to undertake a measurement program that would describe the LOS characteristics of various types of terrain. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N77-26610*# Wyle Labs., Inc., Huntsville, Ala.
ASSEMBLY AND TESTING OF A 1.8 BY 3.7 METER FRESNEL LENS SOLAR CONCENTRATOR Final Report
J. E. Robertson May 1977 72 p refs
(Contract NAS8-31662)
(NASA-CR-150300; TM-77-5) Avail: NTIS HC A04/MF A01 CSCL 10A

A project was initiated to establish a technical data base on line focusing acrylic Fresnel lenses for use in a solar collector system that could generate temperatures in the range of 200 C to 370 C. The effort was originally directed toward electric power generation in the 100 to 10,000 kWe range using a distributed collector approach. However, as the program progressed, it centered on the development of a concentrator/collector subsystem concept that could meet the general requirement of thermal delivery within the 200 C to 370 C range. The expanded list of possible applications includes commercial heating/cooling and industrial process heat as well as electric power generation. D.M.L.

N77-26611*# Alabama Univ., Huntsville. Johnson Environmental and Energy Center.
SOLAR HEATING AND COOLING TECHNICAL DATA AND SYSTEMS ANALYSIS Progress Report, Oct. 1974 - 30 Apr. 1977
D. L. Christensen May 1977 152 p
(Contract NAS8-31293)
(NASA-CR-150305) Avail: NTIS HC A08/MF A01 CSCL 10A

The research activities described herein were concentrated on the areas of economics, heating and cooling systems, architectural design, materials characteristics, climatic conditions, educational information packages, and evaluation of solar energy systems and components. Author

N77-26612*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FACTORS AFFECTING THE OPEN-CIRCUIT VOLTAGE AND ELECTRODE KINETICS OF SOME IRON/TITANIUM REDOX FLOW CELLS
Margaret A. Reid and Randall F. Gahn May 1977 17 p refs Presented at the Symp. on Electrode Mater. and Processes for Energy Conversion and Storage, Philadelphia, 8-13 May 1977; sponsored by the Electrochem. Soc., Inc.
(Contract E(49-28)-1002)
(NASA-TM-X-73669; E-9193; ERDA/NASA-1002/77/10) Avail: NTIS HC A02/MF A01 CSCL 10C

Performance of the iron-titanium redox flow cell was studied as a function of acid concentration. Anion permeable membranes separated the compartments. Electrodes were graphite cloth. Current densities ranged up to 25 mA/square centimeter. Open-circuit and load voltages decreased as the acidity was increased on the iron side as predicted. On the titanium side, open-circuit voltages decreased as the acidity was increased in agreement with theory, but load voltages increased due to decreased polarization with increasing acidity. High acidity on the titanium side coupled with low acidity on the iron side gives the best load voltage, but such cells show voltage losses as they are repeatedly cycled. Analyses show that the bulk of the voltage losses are due to diffusion of acid through the membrane. Author

N77-26613*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VIBRATION CHARACTERISTICS OF A LARGE WIND TURBINE TOWER ON NON-RIGID FOUNDATIONS
Suey T. Yee, Tse-Young P. Cang, R. J. Scavuzzo, David H. Timmerman, and John W. Fenton May 1977 34 p refs
(Contract E(49-26)-1004)
(NASA-TM-X-73670; E-9194; ERDA/NASA-1004/77/1) Avail: NTIS HC A03/MF A01 CSCL 10A

Vibration characteristics of the Mod-OA wind turbine supported by nonrigid foundations were investigated for a range of soil rigidities. The study shows that the influence of foundation rotation on the fundamental frequency of the wind turbine is quite significant for cohesive soils or loose sand. The reduction in natural frequency can be greater than 20 percent. However, for a foundation resting on well graded, dense granular materials or bedrock, such effect is small and the foundation can be treated as a fixed base. Author

N77-26614*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NEW BATTERIES AND THEIR IMPACT ON ELECTRIC VEHICLES
Havey J. Schwartz Apr. 1977 15 p refs Presented at Intern. Electric Vehicle Exposition, Chicago, 26-29 Apr. 1977; sponsored by Electric Vehicle Council Sponsored by ERDA
(NASA-TM-X-73672; E-9197; ERDA/NASA-1011/77/3) Avail: NTIS HC A02/MF A01 CSCL 10C

The selection of batteries to power electric motor vehicles is discussed. The problem of evaluating battery performance and the availability of different batteries are considered. D.M.L.

N77-26615*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY RESULTS OF ACCELERATED EXPOSURE TESTING OF SOLAR CELL SYSTEM COMPONENTS
Evelyn Anagnostou and Americo F. Forestieri May 1977 18 p
(Contract E(49-26)-1022)
(NASA-TM-X-73674; E-9200; ERDA/NASA-1022/77/14) Avail: NTIS HC A02/MF A01 CSCL 10A

Plastic samples and solar cell sub modules were exposed to an accelerated outdoor environment in Arizona and an accelerated simulated environment in a cyclic ultraviolet exposure tester which included humidity exposure. These tests were for preliminary screening of materials suitable for use in the manufacture of solar cell modules which are to have a 20-year lifetime. The samples were exposed for various times up to six months, equivalent to a real time exposure of four years. Suitable materials were found to be FEP-A, FEP-C, PFA, acrylic, silicone compounds and adhesives and possibly parylene. The method of packaging the sub modules was also found to be important to their performance. Author

N77-26616*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MAGNETIC STIRLING CYCLES: A NEW APPLICATION FOR MAGNETIC MATERIALS
Gerald V. Brown 6 Jun. 1977 6 p refs Presented at the Intern. Magnetics Conf., Los Angeles, 6-10 Jun. 1977; sponsored by the Inst. of Elec. and Electron. Eng.
(NASA-TM-X-73676; E-9196) Avail: NTIS HC A02/MF A01 CSCL 10A

The elements of the cycle are summarized. The basic advantages include high entropy density in the magnetic material, completely reversible processes, convenient control of the entropy by the applied field, the feature that heat transfer is possible during all processes, and the ability of the ideal cycle to attain Carnot efficiency. The mean field theory is used to predict the entropy of a ferromagnet in an applied field and also the isothermal entropy change and isentropic temperature change caused by applying a field. The results for isentropic temperature change are compared with experimental data on Gd. Coarse mixtures of ferromagnetic materials with different Curie points are proposed to modify the path of the cycle in the T-S diagram in order to improve the efficiency or to increase the specific power. Author

N77-26617*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EVALUATION OF INITIAL COLLECTOR FIELD PERFORMANCE AT THE LANGLEY SOLAR BUILDING TEST FACILITY

Robert J. Boyle, Ronald N. Jensen (NASA Langley, Hampton, Va.), and Richard H. Knoll Jun. 1977 22 p refs Presented at the 10th Ann. Meeting of the Am. Sect. of the Intern. Solar Energy Soc., Orlando, Fla.

(NASA-TM-X-73677) Avail: NTIS HC A02/MF A01 CSCL 10A

The thermal performance of the solar collector field for the NASA Langley Solar Building Test Facility is given for October 1976 through January 1977. A 1,180 square meter solar collector field with seven collector designs helped to provide hot water for the building heating system and absorption air conditioner. The collectors were arranged in 12 rows with nominally 51 collectors per row. Heat transfer rates for each row were calculated and recorded along with sensor, insolation, and weather data every five minutes using a minicomputer. The agreement between the experimental and predicted collector efficiencies was generally within five percentage points. Author

N77-26618*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

TEST FACILITY FOR SOLAR-CELL REFERENCE CONDITIONS

Thomas M. Klucher Nov. 1976 16 p refs Presented at 2d Ann. Photovoltaic Measurements Workshop, Baton Rouge, La., 10-12 Nov. 1976

(Contract E(49-26)-1022)

(NASA-CP-2010; ERDA/NASA-1022/76/1; TR-I-2) Avail: NTIS HC A02/MF A01 CSCL 10A

A test facility, intended primarily for long-term monitoring of the global insolation and its components and the concurrent solar cell performance under a wide variety of measureable atmospheric and weather conditions, is described. Instruments for the measurement of insolation, cell performance, turbidity, water vapor, and cloud cover are described. Preliminary evaluation of the hourly data base generated over a two-month period for a range of sky conditions from clear to overcast is presented. Author

N77-26619*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF ATMOSPHERIC PARAMETERS ON SILICON CELL PERFORMANCE

Henry B. Curtis Nov. 1976 19 p refs Presented at 2d Ann. Photovoltaic Measurements Workshop, Baton Rouge, La., 10-12 Nov. 1976

(Contract E(49-26)-1022)

(NASA-CP-2010; ERDA/NASA-1022/76/2; TR-1-7) Avail: NTIS HC A02/MF A01 CSCL 10A

The effects of changing atmospheric parameters on the performance of a typical silicon solar cell were calculated. The precipitable water vapor content, airmass and turbidity were varied over wide ranges and the normal terrestrial distribution of spectral irradiance was studied. The cell short-circuit current was then computed for each spectral irradiance distribution using the cell spectral response. Data are presented in the form of calibration number (cell current/incident irradiance) vs. water vapor content or turbidity. Author

N77-26620*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ERRORS IN SHORT CIRCUIT MEASUREMENTS DUE TO SPECTRAL MISMATCH BETWEEN SUNLIGHT AND SOLAR SIMULATORS

Henry B. Curtis 1976 26 p ref Presented at the 2d Ann. Photovoltaic Measurements Workshop, Baton Rouge, La., 10-12 Nov. 1976

(Contract E(49-26)-1022)

(NASA-CR-2010; ERDA/NASA-1022/76/3; TR-2-2) Avail: NTIS HC A03/MF A01 CSCL 10A

Errors in short circuit current measurement were calculated for a variety of spectral mismatch conditions. The differences in spectral irradiance between terrestrial sunlight and three types of solar simulator were studied, as well as the differences in spectral response between three types of reference solar cells and various test cells. The simulators considered were a short arc xenon lamp AMO sunlight simulator, an ordinary quartz halogen lamp, and an ELH-type quartz halogen lamp. Three types of solar cells studied were a silicon cell, a cadmium sulfide cell and a gallium arsenide cell. Author

N77-26621*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CONSIDERATION OF DESIGN AND CALIBRATION OF TERRESTRIAL REFERENCE SOLAR CELLS

V. G. Weizer [1976] 28 p refs Presented at 2d Ann. Photovoltaic Measurements Workshop, Baton Rouge, La., 10-12 Nov. 1976

(Contract E(49-26)-1022)

(NASA-CP-2010; ERDA/NASA-1022/76/4; TR-2-4) Avail: NTIS HC A03/MF A01 CSCL 10A

A discussion is presented on the problems encountered in the design of a reference cell that meets basic criteria, starting with basic design considerations, and proceeding with the precautions taken to ensure a global monitoring capability. The effects of the variations in atmospheric conditions on the calibration and use of reference cells are presented along with a discussion of the simplifications brought about by the use of spectrally matched test and reference cells. Finally, a method of matching test modules and arrays to reference cells by a red/blue response ratio technique is described. Author

N77-26622*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SOME BASIC CONSIDERATIONS OF MEASUREMENTS INVOLVING COLLIMATED DIRECT SUNLIGHT

An-Ti Chai Nov. 1976 17 p refs Presented at the 2d Ann. Photovoltaic Measurements Workshop, Baton Rouge, La., 10-12 Nov. 1976

(Contract E(49-26)-1022)

(NASA-CP-2010; ERDA/NASA-1022/76/5; TR-2-6) Avail: NTIS HC A02/MF A01 CSCL 10A

The geometry of collimators for devices or instruments dealing with terrestrial direct sunlight is discussed. Effects of the opening angle and slope angle of a collimator on the measurements are investigated with regard to variations of turbidity and air mass. Based on this investigation, geometric dimensions for collimators and certain realistic terrestrial reference conditions are recommended for the purpose of solar cell calibration in terrestrial applications. Author

N77-26623*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SENSITIVITY OF SOLAR-CELL PERFORMANCE TO ATMOSPHERIC VARIABLES. 1: SINGLE CELL

Thomas M. Klucher [1976] 15 p refs Presented at 2d Ann. Photovoltaic Measurements Workshop, Baton Rouge, La., 10-12 Nov. 1976

(Contract E(49-26)-1022)

(NASA-CP-2010; ERDA/NASA-1022/76/6; TR-2-7) Avail: NTIS HC A02/MF A01 CSCL 10A

The short circuit current of a typical silicon solar cell under direct solar radiation was measured for a range of turbidity, water vapor content, and air mass to determine the relation of the solar cell calibration value (current-to-intensity ratio) to those atmospheric variables. A previously developed regression equation was modified to describe the relation between calibration value, turbidity, water vapor content, and air mass. Based on the value

of the constants obtained by a least squares fit of the data to the equation, it was found that turbidity lowers the value, while increase in water vapor increases the calibration value. Cell calibration values exhibited a change of about 6% over the range of atmospheric conditions experienced. Author

N77-26624*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SENSITIVITY OF SOLAR-CELL PERFORMANCE TO ATMOSPHERIC VARIABLES. 2: DISSIMILAR CELLS AT SEVERAL LOCATIONS
Thomas M. Klucher and Russell E. Hart [1976] 16 p refs Presented at the 2d Ann. Photovoltaic Measurements Workshop, Baton Rouge, La., 10-12 Nov. 1976
(Contract E(49-26)-1022)
(NASA-CP-2010; ERDA/NASA-1022/76/7; TR-2-8) Avail: NTIS HC A02/MF A01 CSCL 10A

Several solar cells having dissimilar spectral response curves and cell construction were measured at various locations in the United States to determine sensitivity of cell performance to atmospheric water vapor and turbidity. The locations selected represent a broad range of summer atmospheric conditions, from clear and dry to turbid and humid. Cell short circuit current under direct normal incidence sunlight, the intensity, water vapor and turbidity were measured. Regression equations were developed from the limited data base in order to provide a single method of prediction of cell current sensitivity to the atmospheric variables. Author

N77-26625*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INTRODUCTION TO BASIC SOLAR CELL MEASUREMENTS
Henry W. Brandhorst, Jr. [1976] 31 p refs Presented at 2d Ann. Photovoltaic Measurements Workshop, Baton Rouge, La., 10-12 Nov. 1976
(Contract E(49-26)-1022)
(NASA-CP-2010; ERDA/NASA-1022/76/8; TR-3-1) Avail: NTIS HC A03/MF A01 CSCL 10A

The basic approaches to solar cell performance and diagnostic measurements are described. The light sources, equipment for I-V curve measurement, and the test conditions and procedures for performance measurement are detailed. Solar cell diagnostic tools discussed include analysis of I-V curves, series resistance and reverse saturation current determination, spectral response/quantum yield measurement, and diffusion length/lifetime determination. Author

N77-26626*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INDOOR AND OUTDOOR MEASUREMENTS OF PERFORMANCE OF PHOTOVOLTAIC ARRAYS
Henry B. Curtis [1976] 16 p refs Presented at the 2d Ann. Photovoltaic Measurements Workshop, Baton Rouge, La., 10-12 Nov. 1976
(Contract E(49-26)-1022)
(NASA-CP-2010; ERDA/NASA-1022/76/9; TR-3-3) Avail: NTIS HC A02/MF A01 CSCL 10A

A description of the techniques and methodology for making outdoor I-V measurements of solar cells is given. Temperature and irradiance measurement, experimental arrangement, data acquisition system and I-V data transformations are discussed. Data are presented comparing outdoor measurements to indoor measurements using a pulsed solar simulator. Author

N77-26627*# Duke Univ., Durham, N.C. Dept. of Engineering.
AIR-GAPPED STRUCTURES AS MAGNETIC ELEMENTS FOR USE IN POWER PROCESSING SYSTEMS Ph.D. Thesis
Anil Kumar Ohri 6 Jul. 1977 191 p refs
(Grant NGL-34-001-001)
(NASA-CR-153289) Avail: NTIS HC A09/MF A01 CSCL 10B

Methodical approaches to the design of inductors for use in LC filters and dc-to-dc converters using air gapped magnetic structures are presented. Methods for the analysis and design of full wave rectifier LC filter circuits operating with the inductor current in both the continuous conduction and the discontinuous conduction modes are also described. In the continuous conduction mode, linear circuit analysis techniques are employed, while in the case of the discontinuous mode, the method of analysis requires computer solutions of the piecewise linear differential equations which describe the filter in the time domain. Procedures for designing filter inductors using air gapped cores are presented. The first procedure requires digital computation to yield a design which is optimized in the sense of minimum core volume and minimum number of turns. The second procedure does not yield an optimized design as defined above, but the design can be obtained by hand calculations or with a small calculator. The third procedure is based on the use of specially prepared magnetic core data and provides an easy way to quickly reach a workable design. Author

N77-26628*# Westinghouse Research Labs., Pittsburgh, Pa.
ENERGY CONVERSION ALTERNATIVES STUDY (ECAS), PHASE 2. VOLUME 1: SUMMARY AND COMBINED GAS-STREAM TURBINE PLANT WITH AN INTEGRATED LOW-BTU GASIFIER Final Report
D. T. Beecher 1 Nov. 1976 497 p refs
(Contracts NAS3-19407; E(49-18)-1751; Grant NSF AG-551)
(NASA-CR-134942-Vol-1; Rept-76-9E9-ECAS-R2-Vol-1) Avail: NTIS HC A21/MF A01 CSCL 10B

A parametric analysis of energy conversion concepts using coal or coal derived fuels is presented. Conceptual plant designs were formulated for three advanced power conversion concepts; (1) a combined gas steam turbine cycle whose gas turbines are air cooled, and burn a low Btu gas from coupled pressurized fluidized bed gasifiers, (2) a combined gas steam turbine cycle whose gas turbine expanders contain ceramic elements and burn a semiclean coal derived liquid from the H coal process, and (3) an advanced steam plant whose steam is pressurized fluidized bed boilers. A detailed analysis of performance, plant layout, capital cost, cost of electricity, natural resource requirements, and emissions of the three advanced concepts is also included. B.B.

N77-26629*# Westinghouse Research Labs., Pittsburgh, Pa.
ENERGY CONVERSION ALTERNATIVES STUDY (ECAS), PHASE 2. VOLUME 2: SUMMARY AND COMBINED GAS-STEAM TURBINE PLANT USING COAL DERIVED LIQUID FUEL Final Report
D. T. Beecher 15 Oct. 1976 334 p refs
(Contracts NAS3-19407; E(49-18)-1751; Grant NSF AG-551)
(NASA-CR-134942-Vol-2; Rept-76-9E9-ECAS-R2-Vol-2) Avail: NTIS HC A15/MF A01 CSCL 10B
For abstract, see N77-26628.

N77-26630*# Westinghouse Research Labs., Pittsburgh, Pa.
ENERGY CONVERSION ALTERNATIVES STUDY (ECAS), PHASE 2. VOLUME 3: SUMMARY AND ADVANCED STEAM PLANT WITH PRESSURIZED FLUIDIZED BED BOILERS Final Report
D. T. Beecher 1 Nov. 1976 398 p refs
(Contracts NAS3-19407; E(49-18)-1751; Grant NSF AG-551)
(NASA-CR-134942-Vol-3; Rept-76-9E9-ECAS-R2-Vol-3) Avail: NTIS HC A17/MF A01 CSCL 10B
For abstract, see N77-26628.

N77-26631*# General Electric Co., Schenectady, N.Y.
ENERGY CONVERSION ALTERNATIVES STUDY (ECAS), PHASE 2. VOLUME 1: EXECUTIVE SUMMARY Final Report
J. C. Corman and G. R. Fox Dec. 1976 54 p refs
(Contracts NAS3-19406; E(49-18)-1751; Grant NSF AG-551)
(NASA-CR-134949-Vol-1; SRD-76-064-1-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 10B

A data base for the comparison of advanced energy conversion systems for electric utility baseload applications using coal or coal-derived fuels was developed. Conceptual designs were developed for seven systems to permit estimates of power plant efficiency, capital cost, environmental intrusion characteristics, natural resource requirements, and cost of electricity at an assumed capacity factor of 65%. The systems studied were advanced steam with atmospheric fludized bed (AFB) and pressurized fluidized bed (PFB) heat input subsystems, a closed

helium gas turbine (organic bottoming) with an AFB, a potassium topping cycle with a PFB, a combined cycle gas turbine--water cooled--burning a coal-derived liquid fuel, a combined cycle gas turbine--air cooled--integrated with LBtu gasification, and an open cycle MHD system. An emissions limit target was specified for the power plant conceptual designs. A steam power plant (3,500 psig/1000 F/1000 F) with a coal-burning radiant furnace and a wet lime stack gas scrubber (stack reheat to 250 F), analyzed in a study using the same groundrules as ECAS, were used as references for comparison. All of the systems exhibited an estimated efficiency better than the 32% reference case. Five of the systems showed a lower cost of electricity than the 39.8 mills/kWh reference case. Development plans and cost estimates were prepared for the energy conversion portion of the respective systems. An implementation assessment was performed to estimate the potential applicability of the advanced energy conversion systems in electric utility generation systems. Author

N77-26632*# General Electric Co., Schenectady, N.Y.
ENERGY CONSERVATION ALTERNATIVES STUDY (ECAS), PHASE 2: VOLUME 2: ADVANCED ENERGY CONVERSION SYSTEMS, - CONCEPTUAL DESIGNS. PART 1: ANALYTICAL APPROACH Final Report
J. C. Corman, A. S. Robertson, R. D. Stewart, T. A. V. Cassel, and G. G. Johnson Dec. 1976 97 p refs
(Contracts NAS3-19406; E(49-18)-1751; Grant NSF AG-551)
(NASA-CR-134949-Vol-2-Pt-1; SRD-76-064-2-Vol-2-Pt-1)
Avail: NTIS HC A05/MF A01 CSCL 10B
For abstract, see N77-26631.

N77-26633*# General Electric Co., Schenectady, N.Y.
ENERGY CONVERSION ALTERNATIVES STUDY (ECAS), PHASE 2. VOLUME 2: ADVANCED ENERGY CONVERSION SYSTEMS - CONCEPTUAL DESIGNS. PART 2: CLOSED TURBINE CYCLES Final Report
D. H. Brown, B. D. Pomeroy, and R. P. Shah Dec. 1976 274 p refs
(Contracts NAS3-19406; E(49-18)-1751; Grant NSF AG-551)
(NASA-CR-134949-Vol-2-Pt-2; SRD-76-064-2-Vol-2-Pt-2)
Avail: NTIS HC A12/MF A01 CSCL 10B
For abstract, see N77-26631.

N77-26634*# General Electric Co., Schenectady, N.Y.
ENERGY CONVERSION ALTERNATIVES STUDY (ECAS), PHASE 2. VOLUME 2: ADVANCED ENERGY CONVERSION SYSTEMS - CONCEPTUAL DESIGNS. PART 3: OPEN CYCLE GAS TURBINES AND OPEN CYCLE MHD Final Report
L. P. Harris and R. P. Shah Dec. 1976 277 p refs
(Contract NAS3-19406; E(49-18)-1751; Grant NSF AG-551)
(NASA-CR-134949-Vol-2-Pt-3; SRD-76-064-2-Vol-2-Pt-3)
Avail: NTIS HC A13/MF A01 CSCL 10B
For abstract, see N77-26631.

N77-26635*# General Electric Co., Schenectady, N.Y.
ENERGY CONVERSION ALTERNATIVES STUDY (ECAS), PHASE 2. VOLUME 2: ADVANCED ENERGY CONVERSION SYSTEMS: CONCEPTUAL DESIGNS. PART 4: SUMMARY OF RESULTS Final Report
D. H. Brown, J. C. Corman, G. G. Johnson, W. J. MacFarland, B. D. Pomeroy, and D. A. Woodford Dec. 1976 92 p refs
(Contracts NAS3-19406; E(49-18)-1751; Grant NSF AG-551)
(NASA-CR-134949-Vol-2-Pt-4; SRD-76-064-2-Vol-2-Pt-4)
Avail: NTIS HC A05/MF A01 CSCL 10B
For abstract, see N77-26631.

N77-26636*# General Electric Co., Schenectady, N.Y.
ENERGY CONVERSION ALTERNATIVES STUDY (ECAS), PHASE 2. VOLUME 3: RESEARCH AND DEVELOPMENT PLANS AND IMPLEMENTATION ASSESSMENT Final Report
R. R. Bass, D. H. Brown, J. C. Corman, L. P. Harris, B. D. Pomeroy, and R. P. Shah Dec. 1976 347 p refs
(Contracts NAS3-19406; E(49-18)-1751; Grant NSF AG-551)
(NASA-CR-134949-Vol-3; SRD-76-064-3) Avail: NTIS HC A15/MF A01 CSCL 10B
For abstract, see N77-26631.

N77-26637*# United Technologies Corp., South Windsor, Conn.
ENERGY CONVERSION ALTERNATIVES STUDY (ECAS), PHASE 2. INTEGRATED COAL GASIFIER/MOLTEN CARBONATE FUEL CELL POWERPLANT CONCEPTUAL DESIGN AND IMPLEMENTATION ASSESSMENT Final Report
J. M. King 19 Oct. 1976 171 p refs Prepared in cooperation with Burns and Roe, Inc. and the Inst. of Gas Technol.
(Contract NAS3-19586)
(NASA-CR-134955; FCR-0237) Avail: NTIS HC A08/MF A01 CSCL 10A
For abstract, see N77-26631.

N77-26638# Rensselaer Polytechnic Inst., Troy, N. Y. Center for Technology Assessment.
AN ANALYSIS OF THE FEASIBILITY OF WINDMILLS FOR POWER GENERATION IN NEW YORK STATE
Robert Duffy Oct. 1976 136 p refs
(RPI-TA-17) Avail: NTIS HC A07/MF A01
The potential use of wind energy as a source of generating electric power as a methodology is described for evaluating the economic viability and acceptability of windmills for wind energy conversion in a large size such as New York State. The minimum cost of energy production for a system yielding high levels of energy is determined. Elements in the evaluation include: (1) an analysis of recorded wind data from which available wind energy levels may be determined; (2) an engineering analysis of known windmill concepts to determine those specific windmills which have the greatest potential for large scale generation of synchronous ac current; and (3) a coupling of the selected mills and the available wind energy profiles with capital investment and operating cost information to determine isoeconomic contour lines throughout the state. Author

N77-26639# AIA Research Corp., Washington, D. C.
SOLAR DWELLING DESIGN CONCEPTS
May 1976 147 p refs Sponsored in part by NBS
(Contract HUD-H-5574)
(HUD-PDR-156(2)) Avail: NTIS MF A01; SOD HC $2.30 as 023-000-00334-1
Design considerations and numerous dwelling and site design concepts for solar heating and cooling are listed. A basis for future solar design is identified. Author

N77-26640# Energy Research Corp., Danbury, Conn.
NEW MATERIALS FOR FLUOROSULFONIC ACID ELECTROLYTE FUEL CELLS Interim Report, Dec. 1975 - Oct. 1976
Sandors G. Abens, Bernard S. Baker, Michael George, and Stanley Januszkiewicz Feb. 1977 31 p refs
(Contract DAAK02-75-C-0045)
(AD-A036988; ERC-0123-3; IR-3) Avail: NTIS HC A03/MF A01 CSCL 10/2
Hydrogen-air fuel cells were evaluated with both TFMSA (Trifluoromethane sulfonic acid) monohydrate and dilute TFMSA. Tolerance against flooding was increased by use of thick supported catalyst electrodes with the monohydrate. Fuel cells with 63% TFMSA were operated at room temperature for over 1,000 hours with no significant decay. The evaluation of supported platinum and tungsten carbide anode catalysts with dilute TFMSA was initiated. Silicon carbide was investigated as a matrix material with TFMSA. Author (GRA)

N77-26641# Energy Research Corp., Danbury, Conn.
FUEL CELL STACKS Interim Technical Report, Mar. - Aug. 1976
S. G. Abens and Bernard S. Baker Feb. 1977 31 p
(Contract DAAK02-74-C-0367)
(AD-A037586; ERC-7396-4; ITR-4) Avail: NTIS HC A03/MF A01 CSCL 10/2
Production and testing of phosphoric acid fuel cell stacks is described. Electrodes, matrices, and bipolar gas distribution plates with an active area of 0.4 sq. ft. have been tested. Initial performance of 10- and 35- cell stacks has been obtained. Some stacks have been operated for over 2,000 hours at 300F, and tolerance to CO has been demonstrated. Life testing of stacks has been impeded by lack of complete gastightness and deterioration of gas diffusion plates. Author (GRA)

N77-26642# Utah Univ., Salt Lake City. Dept. of Mechanical Engineering.
UNIVERSITY OF UTAH DIRECT CONTACT GEOTHERMAL POWER PROJECT REPORT. A COMPUTER PROGRAM FOR DETERMINING THE THERMODYNAMIC PROPERTIES OF WATER
David H. Riemer, Harold R. Jacobs, and Robert F. Boehm 1976 73 p refs
(Contract AT(10-1)-1523; Grant ERDA-AER-75-01039)
(UTEC-ME-76-171) Avail: NTIS HC A04/MF A01

A program was written to be used as a subroutine. The program determines the thermodynamic properties of water given any of the following pairs of knowns to define a thermodynamic state: pressure and entropy, pressure and enthalpy, pressure and quality, temperature and pressure, or temperature and quality. These five pairs of knowns allow the user to evaluate any thermodynamic cycle using water as a working fluid. The report includes a complete derivation of equations, program listing, program symbol description, a complete set of flow charts and a sample steam turbine calculation. ERA

N77-26643# AiResearch Mfg. Co., Phoenix, Ariz.
PRELIMINARY FAILURE MODES, EFFECTS AND CRITICALITY ANALYSIS (FMECA) OF THE CONCEPTUAL BRAYTON ISOTOPE POWER SYSTEM (BIPS) FLIGHT SYSTEM
L. G. Miller 12 Jan. 1976 68 p refs
(Contract EY-76-C-03-1123)
(TID-27251) Avail: NTIS HC A04/MF A01

A failure modes, effects and criticality analysis (FMECA) was made of the Brayton Isotope Power System Flight System (BIPS-FS) as presently conceived. The components analyzed include: Mini-BRU; Heat Source Assembly (HSA); Mini-Brayton Recuperator (MBR); Space Radiator; Ducts and Bellows, Insulation System; Controls; and Isotope Heat Source (IHS). ERA

N77-26644# AiResearch Mfg. Co., Phoenix, Ariz.
BRAXTON ISOTOPE POWER SYSTEM. PHASE 1: (GROUND DEMONSTRATION SYSTEM) CONFIGURATION CONTROL DOCUMENT (CCD)
15 Mar. 1976 238 p refs
(Contract EY-76-C-03-1123)
(TID-27252; AiResearch-75-311274B) Avail: NTIS HC A11/MF A01

The configuration control document (CCD) defines the BIPS-GDS configuration. The GDS (Ground Documentation Syst.) configuration is similar to a conceptual flight system design, referred to as the (Brayton Isotope Power System-Flight System) which is discussed. The BIPS is being developed as a 500 to 2,000 W(e),7-y life, space power system utilizing a closed Brayton cycle gas turbine engine to convert thermal energy (from an isotope heat source) to electrical energy at a net efficiency exceeding 25 percent. ERA

N77-26645# Thermo Electron Corp., Waltham, Mass.
ZIRCONIA-FOIL COMPATIBILITY TEST. PHASE 1
1 Oct. 1976 31 p refs Prepared for AiResearch Mfg. Co., Phoenix, Arizona
(Contracts EY-76-C-03-1123)
(TE-4219-28-77) Avail: NTIS HC A03/MF A01

The compatibility of zirconia powder with candidate foil materials for application to the Brayton Isotope Power System (BIPS) is investigated. The items of concern are: (1) higher than anticipated rate of nickel vaporization, (2) compatibility of the zirconia coating with nickel above 600 C; and (3) compatibility of the zirconia coating with columbium at temperatures up to 950 C. Chemical interaction between the zirconia coating and the substrate foil would degrade the insulation characteristics of the Multifoil. The tests investigated the compatibilities of zirconia coatings with nickel, niobium, molybdenum and oxidized nickel foils. The data from these compatibility tests provide additional information for system modification. ERA

N77-26646# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
EFFECTS OF ATMOSPHERIC VARIABILITY ON ENERGY UTILIZATION AND CONSERVATION Final Report, 1 Jul. 1975 - 31 Oct. 1976
Elmar R. Reiter, G. R. Johnson, W. L. Somervell, Jr., E. W. Sparling, E. Dreiseitly, B. C. MacDonald, J. P. McGuirk, and A. M. Starr Nov. 1976 86 p refs
(Contract EY-76-S-02-1340)
(COO-1340-52) Avail: NTIS HC A05/MF A01

A physical-adaptive model of the space-conditioning demand for energy and its response to changes in weather regimes was developed. This model includes parameters pertaining to engineering factors of building construction, to weather-related factors, and to socio-economic factors. Preliminary testing of several components of the model on the city of Greeley, Colorado, yielded most encouraging results. A CRT-display model for energy demand within the conterminous United States has passed preliminary tests. A major effort was expended to obtain disaggregated data on energy use from utility companies throughout the United States. The study of atmospheric variability revealed that the 22- to 26-day vacillation in the potential and kinetic energy modes of the Northern Hemisphere is related to the behavior of the planetary long-waves, and that the midwinter dip in zonal available potential energy is reflected in the development of blocking highs. ERA

N77-26647# Sandia Labs., Albuquerque, N. Mex.
SILICON SOLAR CELL DEVELOPMENT FOR CONCENTRATED-SUNLIGHT, HIGH-TEMPERATURE APPLICATIONS
J. F. Fossum and E. L. Burgess 1976 7 p refs
(Contract E(29-1)-789)
(SAND-76-5311; Conf-761130-1) Avail: NTIS HC A02/MF A01

The development of silicon cells for use in concentrated-sunlight, high-temperature environments, based on theory and experiment, is presented. The theoretical work is aided by exact numerical simulations of the cells. Suggested cell designs are then fabricated using standard integrated circuit processing techniques. The designs are verified through computer-controlled testing of the cells at solar illuminations up to 90 suns and temperatures up to 100 C. The development of a 5-cm-diameter silicon wafer cell for a 50-sun, approximately 100 C application is emphasized. ERA

N77-26648# Sandia Labs., Albuquerque, N. Mex. Applied Mathematics Div.
ANALYSIS OF MAGNETIC SUSPENSION
Eugene A. Aronson Nov. 1976 21 p refs
(Contract E(29-1)-789)
(SAND-76-0532) Avail: NTIS HC A02/MF A01

Magnetic bearings are considered for the frictionless suspension of high speed rotating cylinders for energy storage. The inherent instability of magnetic suspension and the required feedback control system are discussed. A three-loop suspension system is described. An ancillary result shows that tapering of the magnetic pole pieces at the gap is detrimental to the magnetic suspension. ERA

N77-26649# Los Alamos Scientific Lab., N. Mex.
SUPERCONDUCTING ENERGY STORAGE DEVELOPMENT FOR ELECTRIC UTILITY SYSTEMS
R. D. Turner, H. J. Boenig, and W. V. Hasenzahl 1976 16 p refs Presented at 3d Ann. Conf. on Energy, Rolla, Mo., 13 Oct. 1976
(Contract W-7405-eng-36)
(LA-UR-76-2294; Conf-761038-1) Avail: NTIS HC A02/MF A01

Model SMES experiments were performed to show that magnetic energy storage in a superconducting magnet is a viable alternate to energy storage methods which are being built today. Component tests on a model SMES system include 12 pulse converters, automatic and manual converter power control system, and high current superconductors were performed to evaluate and develop systems which can be used on the 100 MJ SMES system that was designed. Test circuits were designed and used for economical and nondestructive testing of magnets for superconductor performance and evaluation. A closed-loop model SMES system was developed and built to study the electrical characteristics of the system. Initial test results were obtained for a symmetrically and asymmetrically triggered twelve-pulse converter. The asymmetrically triggered bridge shows the lower reactive power requirement, but a more distorted line current. Tests with the automatic control system show that a

SMES system has switching times between the charging and discharging mode of about a cycle and a half. ERA

N77-26650# Brookhaven National Lab., Upton, N.Y. Policy Analysis Div.

ENERGY SITUATION IN NEW ENGLAND

Joel P. Brainard, James S. Munson, and Philip F. Palmedo Nov. 1976 57 p refs

(Contract EY-76-C-02-0016)

(BNL-50580) Avail: NTIS HC A04/MF A01

A concise overview is given of the facts of the energy situation in New England and of attitudes within the region towards current energy issues. Many of the central problems of U.S. energy policy are manifested in the region in a magnified form. The region entered the period of energy shortages and increasing prices in an economically declining condition. Manufacturing activity and jobs were being lost to other regions of the country, and personal income was increasing at significantly slower rates. With essentially no indigenous energy resources, New England is an energy-importing region; over 60 percent of the fuels it consumes is imported from abroad. Although the future supply of energy to the region is critically dependent on energy resource policies, policies related for example to coal and oil shale development, the region's concerns cluster around policies and technologies that are perceived to have a more direct impact on its energy welfare. Energy conservation, solar energy, nuclear power, offshore oil development and, in general, the price of energy to the region are discussed. ERA

N77-26651# California Univ., Livermore. Lawrence Livermore Lab.

WILL A RAPIDLY EXPANDING POWER-GENERATING SYSTEM BE PART OF THE ENERGY PROBLEM OR PART OF ITS SOLUTION

G. D. Sauter 12 Aug. 1976 24 p refs Presented at Frontiers of Power Technol. Conf., Stillwater, Okla., 27-28 Oct. 1976

(Contract W-7405-eng-48)

(UCRL-78500; Conf-761030-1) Avail: NTIS HC A02/MF A01

A methodology for the dynamic net energy analysis of an expanding system of identical power-generating plants is described. Based on this methodology, which is applicable to all types of power plants, a numerical model for simulating the energy dynamics of an expanding power-generating system is developed. The results of applying the model to several illustrative examples are presented and discussed. ERA

N77-26652# California Univ., Livermore. Lawrence Livermore Lab.

TEMPERATURE DEPENDENCE OF THE PHOTOVOLTAIC PERFORMANCE OF SI CELLS UNDER BLUE, WHITE, AND NEAR-BANDGAP IRRADIATION

E. Fischer-Colbrie, R. Wichner, and E. J. Charlson 3 Dec. 1976 7 p refs Presented at 12th IEEE Photovoltaic Specialist Conf., Baton Rouge, Louisiana, 15 Nov. 1976

(Contract W-7405-eng-48)

(UCRL-76203; Conf-761130-3) Avail: NTIS HC A02/MF A01

The temperature depenence of V/sub oc/ and I/sub sc/ was investigated for various designs of solar cells under blue, white, and near-infrared illumination bands of equal photodensity thus producing carriers at different depths in the various cells. It was found that V/sub oc/vs. temperature relation showed practically no dependence on the depth at which excitation occurred. Delta V/sub oc/ was about twice as large for non-homojunction cells than for homojunctions. The change in short circuit current with temperature, however, is sensitive to the depth at which carrier generation occurs. A decrease of I/sub sc/, with increasing temperature has been shown for excitation near the surface, a strong increase for excitation deep in the bulk with values for the white light showing an average of both. ERA

N77-26653# Sandia Labs., Albuquerque, N. Mex.

EFFECTS OF SPECTRAL VARIATIONS ON SILICON CELL OUTPUT

E. C. Boes and I. J. Hall 1976 14 p Presented at Terrestrial PV Measurements Workshop, Baton Rouge, Louisiana, 10 Nov. 1976

(Contract E(29-1)-789)

(SAND-76-9142; Conf-761129) Avail: NTIS HC A02/MF A01

The performance of silicon solar cell at a specific location is usually predicted by multiplying the solar radiation incident at the site by the solar cell's efficiency. This efficiency is specified as the ratio of the cell's output to the radiant energy input to the cell under specified conditions. It would be better to use a procedure which takes into account the fact that the performance of silicon solar cells depends upon the spectral distribution of the incoming energy. This is generally not possible because there are very few records of the spectral distribution of terrestrial solar radiation. One existing data source consists of spectral measurements of daily, total-horizontal radiation. These data have been analyzed to determine the magnitude and character of the effects in silicon cell output resulting from real variations in the terrestrial solar spectrum. ERA

N77-26654# Atomics International, Canoga Park, Calif.

HYDRATION-DEHYDRATION CYCLING OF MgO-Mg(OH)2 FOR APPLICATION TO SOLAR HEAT STORAGE SYSTEMS

G. Ervin 30 Sep. 1976 19 p

(Contract E(04-3)-0701)

(AI-ERDA-13178) Avail: NTIS HC A02/MF A01

The system design requires a knowledge of rates of the dehydration and hydration reactions, and, in order that these rates be significant for practical applications, it must be shown that these rates are maintained as the material is cycled repeatedly through the anhydrous and hydrated condition. For solar heat storage operating on a daily cycle, for example, a 3-yr life requires somewhat more than 1,000 cycles. Besides the effect of cycling on reaction kinetics, the extent of corrosion by the inorganic oxide/hydroxide on its containment vessel during cycling is an important parameter. Also, since one form of the active material that appears to have some advantages is that of granules held together by an inorganic cement, it is important in this case to know if the granules are broken down by cycling. ERA

N77-26655# Atomics International, Canoga Park, Calif.

EXPERIMENTAL TEST OF GAS HEAT TRANSFER SYSTEM FOR HYDROXIDE HEAT STORAGE

G. Ervin 29 Oct. 1976 23 p

(Contract E(04-3)-0701)

(AI-ERDA-13176) Avail: NTIS HC A02/MF A01

The results of a series of tests using circulating gas as a means of heat transfer are given. On the basis of these results, it is concluded that circulating gas is a technically feasible concept, using steam as heat transfer fluid and using the chemical in the form of a fixed bed of porous granules. ERA

N77-26656# Natural Dynamics, Des Moines, Iowa.

FAST PRODUCTION OF METHANE BY ANAEROBIC DIGESTION Progress Report, 24 Sep. - 24 Oct. 1976

C. D. Finney, R. S. Evans, II, and K. A. Finney Nov. 1976 6 p

(Contract EY-76-C-02-2900)

(COO-2900-6) Avail: NTIS HC A02/MF A01

Three modified five liter standard baffled digesters were constructed and loaded with a stock of thermophilic bacteria. Individual digesters were acclimated to 48, 53, and 58 C at 760 mm mercury absolute for the purpose of determining the effect of temperature on glucose loading rates. ERA

N77-26657# California Univ., Berkeley. Lawrence Berkeley Lab.

RESULTS FROM CIRCUMSOLAR RADIATION MEASUREMENTS

Donald F. Grether, Arlon Hunt, and Michael Wahlig Aug. 1976 8 p refs Presented at Joint Conf. of Am. Section of Intern. Solar Energy Soc. and Solar Energy Soc. of Can., Inc., Winnipeg, Canada, 15 Aug. 1976

(Contract W-7405-eng-48)

(LBL-5292; Conf-760842-18) Avail: NTIS HC A02/MF A01

Circumsolar radiation results from small-angle scattering of direct sunlight from atmospheric aerosols with dimensions on the order of, or greater than the wavelength of light. An

instrument was developed to provide measurements of circumsolar radiation as a function of angular distance from the sun and wavelength, for various atmospheric conditions, geographic locations, and times of year. These measurements are used to predict accurately the performance of solar thermal conversion systems using focusing collectors, and to determine whether pyrheliometer data are adequate for estimating this performance. Sample data are presented for two geographic locations. ERA

N77-26658# California Univ., Berkeley. Lawrence Berkeley Lab. Lab. of Chemical Biodynamics.
HYDROCARBONS VIA PHOTOSYNTHESIS
Melvin Calvin 15 Sep. 1976 62 p refs Presented at ACS Rubber Div. Meeting, San. Francisco, 4 Oct. 1976
(Contract W-7405-eng-48)
(LBL-5387; Conf-761046-1) Avail: NTIS HC A04/MF A01

Photosynthesis, both natural and as a model process, is examined as a possible annually renewable resource for both material and energy. The conversion of carbohydrate from cane and other sources through fermentation alcohol to hydrocarbon may again become economic in the light of improved fermentation technology and the rising price of hydrocarbon. ERA

N77-26659# Oak Ridge National Lab., Tenn.
APPLICATION OF THE ICE-MAKER HEAT PUMP TO AN ANNUAL CYCLE ENERGY SYSTEM
H. C. Fischer and E. A. Nephew Dec. 1976 36 p refs Presented at the ASME Winter Meeting, New York, Dec. 1976
(Contract W-7405-eng-26)
(CONF-761107-13) Avail: NTIS HC A03/MF A01

Design parameters and typical operating characteristics of the ice-maker heat pump are presented and discussed. An economic analysis indicates that the ice-maker heat pump is capable of supplying space heating to buildings at an operating cost of about $4.65/million Btu ($4.41/GJ) of heat delivered at the register. The corresponding operating costs for heat delivery by systems with an air-to-air heat pump, an oil-fired furnace, a gas-fired furnace, and electric resistance heating are: $5.86, $6.30, $6.26, and $11.72 per million Btu, respectively. The cost of supplying domestic hot water by means of an ice-maker heat pump is estimated and the storage of ice for later use as a cooling medium is investigated. Ice storage as a means of saving both money and fuel is analyzed on the basis of daily, weekly, and annual cycles. Particular attention is being given to the design and construction of cost-effective storage bins. ERA

N77-26660# Dubin-Mindell-Bloome Associates, New York.
NEW ENERGY CONSERVATION IDEAS FOR EXISTING AND NEW BUILDINGS
F. S. Dubin 1975 28 p Presented at the 1st ERDA-Wide Energy Conservation Symp., Albuquerque, N. M., 16-18 Sep. 1975
(CONF-750942-2) Avail: NTIS HC A03/MF A01

New equipment and system concepts are outlined, such as utilization of solar energy, heat pumps, heat pipes, desiccant dehumidification, and chilled and hot water storage systems; but it is shown that most of the new ideas are, in fact, innovative use of older technologies which must be reintroduced now. The importance of becoming thoroughly familiar with, and using, innovative systems which are available is stressed, rather than waiting for the development of new products. Examples are presented showing the energy conservation and economic benefits of industrial processes when integrated with building environmental control systems. Some suggestions are included for new product development. Some specific needs are high temperature solar collectors, low temperature absorption refrigeration equipment, and glass which changes its characteristics with varying ambient conditions. ERA

N77-26661# Brookhaven National Lab., Upton, N.Y.
COMFORT RANGE THERMAL STORAGE
A. L. Berlad (State Univ. of N. Y., Stony Brook), H. C. Linn (State Univ. of N. Y., Stony Brook), F. J. Alzano, and J. Batey 1976 28 p refs Presented at 1976 ASME Winter Ann. Meeting, New York, 28 Nov. - 3 Dec. 1976
(Contract E(30-1)-16)
(BNL-21591; Conf-761107-9) Avail: NTIS HC A03/MF A01

The dynamic features of small buildings which are capable of substantial Comfort Range Thermal Storage (CRTS) are discussed. Some of the quantitative considerations in the effective coupling of the CRTS with existing or required space conditioning devices are indicated. ERA

N77-26662# Oak Ridge National Lab., Tenn.
POTENTIAL USE OF POWER PLANT REJECT HEAT IN COMMERCIAL AQUACULTURE
M. Olszewski Jan. 1977 46 p refs
(Contract W-7405-eng-26)
(ORNL/TM-5663) Avail: NTIS HC A03/MF A01

Current research and commercial activities in aquaculture operations have been reviewed. An aquaculture system using mostly herbivorous species in pond culture is proposed as a means of using waste heat to produce reasonably priced protein. The system uses waste water streams, such as secondary sewage effluent, animal wastes, or some industrial waste streams as a primary nutrient source to grow algae, which is fed to fish and clams. Crayfish feed on the clam wastes thereby providing a clean effluent from the aquaculture system. Alternate fish associations are presented, and it appears that a carp or tilapia association is desirable. An aquaculture system capable of rejecting all the waste heat from a 1,000-MW(e) power station in winter can accommodate about half the summer heat rejection load. ERA

N77-26663# Battelle Columbus Labs., Ohio.
EVALUATION OF THE POTENTIAL ENVIRONMENTAL EFFECTS OF WIND ENERGY SYSTEM DEVELOPMENT
Interim Final Report
Sharron E. Rogers, Michael A. Duffy, Julia G. Jefferis, Philip R. Sticksel, and Duane A. Tolle Aug. 1976 193 p refs
(Contract W-7405-eng-92; Grant NSF AER-75-07378)
(ERDA/NSF-07378-75/1; NSF/RA-706188) Avail: NTIS HC A09/MF A01

The first phase of an evaluation of the potential for environmental effects from the development of wind energy was completed. A keyworded bibliography concerning microclimatic alterations by wind and reactions of flora and fauna to altered wind regimes is presented. This literature serves as background material for discussion of potential microclimatic and ecological effects. ERA

N77-26664# Alaska Univ., College. Geophysical Inst.
STUDY OF ALASKAN WIND POWER AND ITS POSSIBLE APPLICATIONS Final Report, 1 May 1974 - 30 Jan. 1976
Tunis Wentink, Jr. 29 Feb. 1976 183 p refs
(Contract E(45-1)-2229; Grant NSF AER-74-00239A01)
(NSF/RANN/SE/AER74-00239/FR-26) Avail: NTIS HC A09/MF A01

The wind power potential of Alaska, is studied in both the meteorological and applies senses. The wind potential of the world is also treated. Specific goals are the determination of alternative applications and users of wind systems, optimum sites for these, and environmental problems associated with windmills used in Alaska. The program consists of seven tasks. ERA

N77-26665# Battelle Pacific Northwest Labs., Richland, Wash.
OTEC ANNUAL REPORT TO THE DIVISION OF SOLAR ENERGY FOR FY-1976 AND THE TRANSITION QUARTER
Lyle D. Perrigo and G. A. Jensen Nov. 1976 45 p refs
(Contract EY-76-C-06-1830)
(BNWL-2154) Avail: NTIS HC A03/MF A01

The methodology used to guide the technical efforts of the project activity office during its period of startup and before a detailed master plan is developed. The projects developed for funding in FY-1976 and the rationale for their selection are described. A summary of significant technical information, obtained from various projects is presented. ERA

N77-26666# Brookhaven National Lab., Upton, N.Y.
HYDROGEN STORAGE VIA METAL HYDRIDES FOR UTILITY AND AUTOMOTIVE ENERGY STORAGE APPLICATIONS
F. J. Salzano, C. Braun, A. Beufrere, S. Srinivasan, G. Strickland, J. J. Reilly, and C. Waide Aug. 1976 54 p refs Presented at 26th Can. Soc. of Chem. Engr. Meeting, Toronto, 4-6 Oct. 1976
(Contract E(30-1)-16)

(BNL-21723; Conf-761044-1) Avail: NTIS HC A04/MF A01

Hydrogen storage connected with utility energy storage applications and natural gas supplementation are discussed and electric-to-electric storage system is described in some detail. A system of energy storage involving the electrolysis of hydrochloric acid is described which would utilize metal hydrides to store the hydrogen. In addition, the use of metal hydrides for hydrogen storage in automative systems is described. ERA

N77-26667# AiResearch Mfg. Co., Phoenix, Ariz.

SUPPLEMENT ERDA BIPS PRELIMINARY DESIGN REVIEW

1976 84 p refs

(Contract EY-76-03-1123)

(TID-27270) Avail: NTIS HC A05/MF A01

Preliminary design criteria for various components and support systems for the Brayton Isotope Power System are depicted. ERA

N77-26668# Virginia Univ., Charlottesville.

ANALYSIS OF THERMAL PERFORMANCE OF SOLARIS WATER-TRICKLE SOLAR COLLECTOR

J. T. Beard, F. L. Huckstep, W. B. May, Jr., F. A. Iachetta, and L. U. Lilleleht 1976 27 p refs Presented at the Ann. Meeting of the ASME, New York, 29 Nov. 1976

(Contract AT-(40-1)-4927)

(CONF-761107-17) Avail: NTIS HC A03/MF A01

Thermal performance testing and evaluation of the Thomason Solaris water-trickle solar collector were undertaken with the aid of a special outdoor research facility. Results demonstrate the performance of the Thomason 'Solaris' collector with efficiencies ranging from 30 percent up to approximately 75 percent. These results show a nearly linear relationship as a function of the difference between inlet water temperature and the ambient temperature divided by the incident solar energy. The significant scatter in the data results from other variables which are analyzed in the paper. These variables include glazing cleanliness, angle of incidence, water evaporation and condensation, wind condition, and the influence of condensate droplets on the overall solar energy transmitted to the absorbing surface. The performance of the 'Solaris' water-trickle collector is compared with published results for conventional single and double flat-plate collectors. ERA

N77-26669# Virginia Univ., Charlottesville.

EVALUATION OF SOLARIS WATER-TRICKLE SOLAR COLLECTOR AND DEMONSTRATION OF ANNUAL CYCLE COLLECTION AND STORAGE OF SOLAR HEATED WATER

J. T. Beard, F. A. Iachetta, L. U. Lilleleht, J. W. Dickey, F. L. Huckstep, and W. B. May, Jr. 1976 18 p refs Presented at Conf. on Solar 3 Capturing the Sun, Evanston, Ill., 20 Nov. 1976

(Contract E(40-1)-4927)

(CONF-761143-1) Avail: NTIS HC A02/MF A01

Research on the thermal performance of the Thomason Solaris water-trickle solar collector is described. This work includes testing with the aid of a special outdoor collector research facility. Results demonstrate the collection efficiency ranges from 30% up to approximately 75%. Significant variables which influence efficiency include inlet water temperature, ambient temperature, incident solar energy, glazing cleanliness, angle of incidence, wind condition, and the evaporation and condensation which occur within the collector. The thermal performance of the Solaris water-trickle collector is compared with published results for conventional single and double flat-plate collectors. The second project involves the demonstration and evaluation of a system for the year-round collection of solar energy with storage for heating applications. The system resembles a swimming pool with an insulated top which acts as a solar collector as well as a device to limit the evaporative cooling of the water. ERA

N77-26670# Pennsylvania Univ., Philadelphia.

RESEARCH AND DEVELOPMENT OF LOW COST PROCESSES FOR INTEGRATED SOLAR ARRAYS

C. D. Graham, S. Kulkarni, and E. Louis May 1976 247 p refs Prepared jointly with Dow Corning Corp.

(Contract E(11-1)-2721)

(COO-2721-76-1) Avail: NTIS HC A11/MF A01

Potential processes for the production of solar-grade silicon are evaluated from thermodynamic, economic, and technical feasibility points of view. Upgrading of the present arc-furnace process is found most favorable. Experimental studies of the Si/SiF4 transport and purification process show considerable impurity removal and reasonable transport rates. Silicon deformation experiments indicate production of silicon sheet by rolling at 1350 C is feasible. Significant recrystallization by strain-anneal technique has been observed. Experimental recrystallization studies using an electron beam line source are discussed. A maximum recrystallization velocity of approximately 9 m/hr is calculated for silicon sheet. A comparative process rating technique based on detailed cost analysis is presented. ERA

N77-26671# Oak Ridge National Lab., Tenn.

NEUTRON TRANSMUTATION DOPED SILICON SOLAR CELLS

R. D. Westbrook and T. L. Polgreen Nov. 1976 11 p Presented at 12th IEEE Photovoltaic Specialists Conf., Baton Rouge, Louisiana, 15 Nov. 1976

(Contract W-7405-eng-26)

(CONF-761130-2) Avail: NTIS HC A02/MF A01

Neutron transmutation doping was used to introduce a precisely controlled and extremely uniform concentration of phosphorus into single crystal and polycrystalline silicon. Experimental solar cells were made from neutron transmutation doped (NTD) single crystal silicon, and from NTD polycrystalline silicon rods, in which the grains range in size from a few microns to several hundred microns. Between the limits of 3 x 10 to the 13th power P per cubic cm to 2 x 10 to the 15th power P per cubic cm, the extent of the work so far with polycrystalline silicon, the ratio of polycrystalline to single crystal open circuit voltage runs from about 0.85 to 0.9; short circuit current from 0.75 to 0.6; maximum power from 0.7 to 0.6; and the fill factor ratios are about unity. ERA

N77-26672# Institute of Gas Technology, Chicago, Ill.

STATUS OF THE STEAM-IRON PROGRAM

Paul B. Tarman and D. V. Punwani 1976 11 p Presented at 8th Syn. Pipeline Gas Symp., Chicago, Ill., 18 Oct. 1976

(Contract E(49-18)-2435)

(CONF-761064-5) Avail: NTIS HC A02/MF A01

Construction of the pilot plant began in September 1975; mechanical completion was achieved in July 1976. Erection of the reactors and of the steel deckwork around them was completed in March 1976. During the latter stages of plant construction, efforts were concentrated on commissioning of the peripheral systems. The slurry vaporizer was tested, and although tests of longer duration will be necessary and concentrated slurries will have to be vaporized, it is believed that the principle of high-pressure slurry vaporization was demonstrated. The internal refractory lining was cured. Several support programs are underway. The kinetic studies program is to develop improved iron solids for use in the steam-iron process. Sixty-seven attrition tests and 56 reactivity tests have been made on a variety of catalysts and support materials. Twenty-six tests were conducted with a Western Kentucky bituminous coal chair. ERA

N77-26673# Giner, Inc., Waltham, Mass.

STUDY OF CORROSION AND ITS CONTROL IN ALUMINUM SOLAR COLLECTORS Progress Report, 1 Jun. - 31 Aug. 1976

J. Giner, L. Sweete, and D. Wong Sep. 1976 26 p

(Contract E(11-1)-2934)

(COO-2934-76-1) Avail: NTIS HC A03/MF A01

Plans and methodology are described for investigating the corrosion of aluminum solar thermal energy collector systems, with the objective of deriving corrosion control methods. The corrosion characteristics of aluminum and selected aluminum alloys in heat transfer fluids, including ethylene glycol water, will be studied experimentally under conditions relevant to the operation of the existing solar collector installations. ERA

N77-26674# General Electric Co., Philadelphia, Pa. Space Div.

GENERAL ELECTRIC COMPANY SURVEY TO DEFINE IMPACT OF STATEWIDE BUILDING CODES ON SOLAR

HVAC SYSTEMS, COMMERCIAL BUILDINGS. NATIONAL SOLAR DEMONSTRATION PROGRAM
Jul. 1976 164 p
(Contract E(11-1)-2683)
(COO-2683-76-11) Avail: NTIS HC A08/MF A01

The potential impact of statewide building codes and solar energy laws on the solar heating and cooling of buildings was investigated. The survey is limited to building and construction related codes and solar energy laws presently issued and enforced. Pending codes or ordinances are also reported. The review of the fire and safety codes was limited to their direct application with construction requirements. Author (ERA)

N77-26675# Cornell Univ., Ithaca, N.Y.
BIOCONVERSION OF AGRICULTURAL WASTES FOR POLLUTION CONTROL AND ENERGY CONSERVATION Final Report
W. J. Jewell, H. R. Davis, W. W. Gunkel, D. J. Lathwell, J. H. Martin, Jr., T. R. McCarty, G. R. Morris, D. R. Price, and D. W. Williams Sep. 1976 341 p refs
(Grant ERDA-NSF 741222-A01)
(TID-27164) Avail: NTIS HC A15/MF A01

A comprehensive study of the feasibility of generating a substitute natural gas on U.S. dairies (40 and 100 cows) and beef feedlots (1,000 head) using the anaerobic fermentation process is made. The feasibility in technical, economic and practical terms is estimated. A dairy farm in northern New York could produce more energy than it consumes, and a feedlot could produce more than 3 times the quantity consumed. The estimated costs of generating methane on 40 and 100 cow dairies and on a 1,000 head beef feedlot were $22.80, $13.40, and $4.50 per 10 to the 6th power kcal. Detailed analyses of the three operations estimated that the actual costs for utilization would increase to $80, $39, and $11 per 10 to the 6th power kcal for specific operations, respectively. Farms with more than 100 cows can begin to consider the technology as an income producing operation. It is therefore concluded that anaerobic fermentation of agricultural wastes has significant potential and should receive increased attention. ERA

N77-26676# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.
COMPARATIVE PERFORMANCE OF SOLAR HEATING WITH AIR LIQUID SYSTEMS Interim Progress Report, 1 Feb. - 30 Aug. 1976
S. Karaki, G. O. G. Lof, and C. C. Smith Aug. 1976 20 p refs Presented at the Intern. Solar Energy Soc. Conf., Winnipeg, Canada, 16-20 Aug. 1976
(Contract E(11-1)-2868)
(COO-2868-1) Avail: NTIS HC A02/MF A01

A performance comparison between an air solar system and a liquid solar system for space heating under nearly equal conditions was obtained. The Colorado State University Solar House I is a liquid solar system which has been in operation since August 1974. Solar House II, which stands adjacent to and has a comparable heating load to Solar House I, is equipped with an air solar system. Solar House I has been continuously monitored since August 1974 and Solar House II has been monitored since February 1976. Performance of the solar systems is reported in terms of the collector efficiency, the amount of space heating and service water heating load provided by solar energy, and the use of electrical energy to operate the solar equipment. General characteristics of the two types of systems are also compared. Information concerning installation, operation, and maintenance of the systems are documented and are discussed. ERA

N77-26677# Mathematical Sciences Northwest, Inc., Bellevue, Wash.
A SOCIAL AND ECONOMIC IMPACT STUDY OF OFFSHORE PETROLEUM AND NATURAL GAS DEVELOPMENT IN ALASKA, PHASE 1 Final Report
15 Oct. 1976 427 p refs Prepared in cooperation with Human Resources Planning Inst., Seattle.
(Contract DI-08550-CT6-46)
(PB-264705/5; MSNW/HRPI-76-274; BLM/SE-77-02) Avail: NTIS HC A19/MF A01 CSCL 10A

The modeling of Alaska's economic experience with hydrocarbon development in the Kenai-Cook Inlet region is presented. The linkages between the petroleum sector and the rest of the Alaskan economy are examined. GRA

N77-26678*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF OUTDOOR EXPOSURE ON SOLAR CELL MODULES IN THE ERDA/NASA LEWIS RESEARCH CENTER SYSTEMS TEST FACILITY
I. Weinberg, Henry B. Curtis, and Americo F. Forestieri Apr. 1977 17 p refs
(Contract E(49-26)-1022)
(NASA-TM-X-73657; E-9173; ERDA/NASA-1022/77/13) Avail: NTIS HC A02/MF A01 CSCL 10A

The effects of outdoor exposure were determined by comparing standard I-V data obtained for the as-received modules with similar data obtained after removal from the field and cleaning with detergent solution. All modules measured in this way exhibited nonrecoverable degradation in P sub maximum varying from 4 to 7 percent. One module exposed for 41 days exhibited partial cell discoloration, loss of front surface metallization over the discolored portion, and a decrease in P sub maximum of 7 percent, tentatively attributed to cell damage. Measurements before and after cleaning showed a recoverable degradation due to dirt accumulation. This recoverable loss in power was 11 percent after 245 days in the field for one brand of module, 6 percent after 48 days for another brand, and 4 1/2 percent for the third brand. Author

N77-26679# Little (Arthur D.), Inc., Cambridge, Mass.
ENVIRONMENTAL CONSIDERATIONS OF SELECTED ENERGY CONSERVING MANUFACTURING PROCESS OPTIONS. VOLUME 2: INDUSTRY PRIORITY REPORT Final Report
Dec. 1976 139 p refs
(Contract EPA-68-03-2198)
(PB-264268/4; EPA-600/7-76-034b-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 10A

The likelihood of new process technology and new practices being introduced by energy intensive industries is assessed, and the environmental impacts of such changes are explored. Volume 2 presents and describes the over-view of the industries considered and presents the methodology used to select industries. GRA

N77-26680# Little (Arthur D.), Inc., Cambridge, Mass.
ENVIRONMENTAL CONSIDERATIONS OF SELECTED ENERGY CONSERVING MANUFACTURING PROCESS OPTIONS. VOLUME 3: IRON AND STEEL INDUSTRY REPORT Final Report
Dec. 1976 107 p refs
(Contract EPA-68-03-2198)
(PB-264269/2; EPA-600/7-76-034c-Vol-3) Avail: NTIS HC A06/MF A01 CSCL 10A

The likelihood of new process technology and new practices being introduced by energy intensive industries is assessed, and the environmental impacts of such changes are explored. Volume 3 deals with the iron and steel industry and examines four alternatives: (1) recovery of carbon monoxide from BOP (basic oxygen process), (2) external desulfurization of blast-furnace hot metal, (3) conversion from wet to dry coke quenching and (4) direct reduction of iron ore, all in terms of relative process economics and environmental/energy consequences. GRA

N77-26681# Little (Arthur D.), Inc., Cambridge, Mass.
ENVIRONMENTAL CONSIDERATIONS OF SELECTED ENERGY CONSERVING MANUFACTURING PROCESS OPTIONS. VOLUME 4: PETROLEUM REFINING INDUSTRY REPORT Final Report
Dec. 1976 193 p
(Contract EPA-68-03-2198)
(PB-264270/0; EPA-600/7-76-034d-Vol-4) Avail: NTIS HC A09/MF A01 CSCL 10A

Different methods of conserving energy in the petroleum refining industry are examined: (1) direct combustion of asphalt in process heaters and boilers, (2) hydrocracking of vacuum bottoms, (3) flexicoking of vacuum bottoms, (4) internal electrical power generation, and (5) hydrogen generation by partial oxidation.

All are evaluated in terms of process economics and environmental/energy consequences. GRA

N77-26682# Little (Arthur D.), Inc., Cambridge, Mass.
ENVIRONMENTAL CONSIDERATIONS OF SELECTED ENERGY CONSERVING MANUFACTURING PROCESS OPTIONS. VOLUME 5: PULP AND PAPER INDUSTRY REPORT Final Report
Dec. 1976 206 p refs
(Contract EPA-68-03-2198)
(PB-264271/8; EPA-600/7-76-034e-Vol-5) Avail: NTIS HC A10/MF A01 CSCL 10A

Different production methods for the pulp and paper industry are examined in depth: (1) alkaline-oxygen pulping, (2) Rapson effluent-free kraft process, (3) thermomechanical pulping, and (4) deinking of old newsprint. All are evaluated in terms of relative economics and environmental/energy consequences. GRA

N77-26683# Little (Arthur D.), Inc., Cambridge, Mass.
ENVIRONMENTAL CONSIDERATIONS OF SELECTED ENERGY CONSERVING MANUFACTURING PROCESS OPTIONS. VOLUME 6: OLEFINS INDUSTRY REPORT
Dec. 1976 154 p
(Contract EPA-68-03-2198)
(PB-264272/6; EPA-600/7-76-034f-Vol-6) Avail: NTIS HC A08/MF A01 CSCL 10A

Relative process economics and environmental/energy consequences of both naphtha and atmospheric gas oil coil cracking are examined and compared with a base line plant using ethane-propane as a feedstock for producing olefins. Emerging technologies for producing olefins are also briefly analyzed. GRA

N77-26684# Little (Arthur D.), Inc., Cambridge, Mass.
ENVIRONMENTAL CONSIDERATIONS OF SELECTED ENERGY CONSERVING MANUFACTURING PROCESS OPTIONS. VOLUME 7: AMMONIA INDUSTRY REPORT Final Report
Dec. 1976 105 p
(Contract EPA-68-03-2198)
(PB-264273/4; EPA-600/7-76-034g-Vol-7) Avail: NTIS HC A06/MF A01 CSCL 10A

The production of ammonia based on coal gasification and the production of ammonia based on heavy oil gasification were analyzed in terms of process economics and environmental/energy consequences. GRA

N77-26685# Little (Arthur D.), Inc., Cambridge, Mass.
ENVIRONMENTAL CONSIDERATIONS OF SELECTED ENERGY CONSERVING MANUFACTURING PROCESS OPTIONS. VOLUME 8: ALUMINA/ALUMINUM INDUSTRY REPORT Final Report
Dec. 1976 155 p
(Contract EPA-68-03-2198)
(PB-264274/2; EPA-600/7-76-034h-Vol-8) Avail: NTIS HC A08/MF A01 CSCL 10A

New process developments for producing alumina from domestic clays as alternatives to the Bayer process were examined: (1) nitric acid leaching process, (2) hydrochloric acid leaching process, and (3) clay chlorination (such as the Toth alumina process). The Alcoa chloride electrolysis process and the application of titanium diboride cathodes to the conventional Hall-Heroult cells for the production of aluminum were also evaluated. All of these alternatives are discussed in terms of relative process economics and environmental/energy consequences. GRA

N77-26686# Little (Arthur D.), Inc., Cambridge, Mass.
ENVIRONMENTAL CONSIDERATIONS OF SELECTED ENERGY CONSERVING MANUFACTURING PROCESS OPTIONS. VOLUME 9: TEXTILE INDUSTRY REPORT Final Report
Dec. 1976 90 p refs
(Contract EPA-68-03-2198)
(PB-264275/9; EPA-600/7-76-034i-Vol-9) Avail: NTIS HC A05/MF A01 CSCL 10A

The environmental, energy, and economic impacts of three model technologies for the textile industry are examined. These include (1) integrated knot fabric mill using advanced processing of 100% polyester fiber, (2) integrated knit fabric mill using solvent processing of 100% polyester fiber, and (3) integrated woven fabric mill using advanced processing of 50/50 polyester cotton fiber mixture. All are evaluated in comparison with a base line technology representing the best of present textile industry practice. GRA

N77-26687# Little (Arthur D.), Inc., Cambridge, Mass.
ENVIRONMENTAL CONSIDERATIONS OF SELECTED ENERGY CONSERVING MANUFACTURING PROCESS OPTIONS. VOLUME 10: CEMENT INDUSTRY REPORT Final Report
Dec. 1976 132 p refs
(Contract EPA-68-03-2198)
(PB-264276/7; EPA-600/7-76-034j-Vol-10) Avail: NTIS HC A07/MF A01 CSCL 10A

The following process options for use in the cement industry are examined: (1) suspension preheater, (2) flash calciner, (3) fluid bed cement process, and (4) conversion to coal fuel from oil and natural gas. Process economics and environmental/energy consequences are considered. GRA

N77-26688# Little (Arthur D.), Inc., Cambridge, Mass.
ENVIRONMENTAL CONSIDERATIONS OF SELECTED ENERGY CONSERVING MANUFACTURING PROCESS OPTIONS. VOLUME 11: GLASS INDUSTRY Final Report
Dec. 1976 127 p refs
(Contract EPA-68-03-2198)
(PB-264277/5; EPA-600/7-76-034k-Vol-11) Avail: NTIS HC A07/MF A01 CSCL 10A

The following new process technologies and practices for the glass industry were evaluated in terms of their impact on relative process economics and their environmental/ energy consequences: (1) coal gasification, (2) direct coal firing, (3) electric melting, (4) coal, hot gas regeneration, and (5) batch preheating. GRA

N77-26689# Little (Arthur D.), Inc., Cambridge, Mass.
ENVIRONMENTAL CONSIDERATIONS OF SELECTED ENERGY CONSERVING MANUFACTURING PROCESS OPTIONS. VOLUME 12: CHLOR-ALKALI INDUSTRY REPORT Final Report
Dec. 1976 90 p refs
(Contract EPA-68-03-2198)
(PB-264278/3; EPA-600/7-76-034l-Vol-12) Avail: NTIS HC A05/MF A01 CSCL 10A

Processes for use in the chlor-alkali industry relating to diaphragm and mercury cell technology are considered, including dimensionally stable anodes, ion exchange membranes and stabilized asbestos diaphragms. These options are evaluated in terms of relative process economics and environmental/energy consequences. GRA

N77-26690# Little (Arthur D.), Inc., Cambridge, Mass.
ENVIRONMENTAL CONSIDERATIONS OF SELECTED ENERGY CONSERVING MANUFACTURING PROCESS OPTIONS. VOLUME 13: PHOSPHORIC ACID INDUSTRY REPORT Final Report
Dec. 1976 96 p refs
(Contract EPA-68-03-2198)
(PB-264279/1; EPA-600/7-76-034m-Vol-13) Avail: NTIS HC A05/MF A01 CSCL 10A

Different methods are evaluated for use in the phosphoric acid industry in terms of relative economics and environmental/ energy consequences. These processes include (1) chemical cleanup of wet process phosphoric acid, (2) solvent extraction process for wet process phosphoric acid, (3) byproduct sulfuric acid for wet process phosphoric acid, and (4) strong acid system for wet process phosphoric acid. GRA

N77-26691# Little (Arthur D.), Inc., Cambridge, Mass.
ENVIRONMENTAL CONSIDERATIONS OF SELECTED ENERGY CONSERVING MANUFACTURING PROCESS OPTIONS. VOLUME 14: PRIMARY COPPER INDUSTRY REPORT Final Report
Dec. 1976 144 p refs

(Contract EPA-68-03-2198)
(PB-264280/9; EPA-600/7-76-034n-Vol-14) Avail: NTIS HC A07/MF A01 CSCL 10A

Several alternative processes are considered for use in the copper industry: (1) Outokumpu flash smelting, (2) Noranda process,(3) Mitsubishi process, (4) oxygen use in smelting, (5) metal recovery from slags (flotation or electric furnace), and (6) Arbiter process. All are evaluated in terms of relative economics and environmental/energy consequences. GRA

N77-26692# Little (Arthur D.), Inc., Cambridge, Mass.
ENVIRONMENTAL CONSIDERATIONS OF SELECTED ENERGY CONSERVING MANUFACTURING PROCESS OPTIONS. VOLUME 15: FERTILIZER INDUSTRY REPORT Final Report
Dec. 1976 74 p
(Contract EPA-68-03-2198)
(PB-264281/7; EPA-600/7-76-034o-Vol-15) Avail: NTIS HC A04/MF A01 CSCL 10A

The two major areas in the fertilizer industry in which energy conservation and pollution control are in conflict are examined; i.e. the reduction of nitrogen oxide emissions from nitric acid plants and switching from natural gas to fuel oil for firing fertilizer dryers where emissions are controlled by bag filters. GRA

N77-26693# Mathematical Sciences Northwest, Inc., Bellevue, Wash.
A SOCIAL AND ECONOMIC IMPACT STUDY OF OFFSHORE PETROLEUM AND NATURAL GAS DEVELOPMENT IN ALASKA, PHASE 2 Final Report
15 Oct. 1976 391 p refs Prepared in cooperation with Human Resources Planning Inst., Seattle and Alaska Consultants, Inc., Anchorage.
(Contract DI-08550-CT5-46)
(PB-264706/3; MSNW/AC-76-2074; BLM/SE-77-02-Pt-2) Avail: NTIS HC A17/MF A01 CSCL 10A

The major effort in the second phase of the study is the application of the modeling techniques used in Phase 1 to areas that have the potential for future hydrocarbon development and the projection of the nature and range of socio-economic impacts that could take place. The sites selected are located in regions that have been identified as having potentially large hydrocarbon reserves. GRA

N77-26694# Dow Chemical Co., Walnut Creek, Calif.
RESEARCH AND DEVELOPMENT IN THE GLASS FIBER SODIUM-SULFUR BATTERY Semiannual Report
Charles Levine 1 Jul. 1976 22 p 2 Vol.
(Contract DAHC15-73-C-0254; ARPA Order 2381)
(AD-A037215) Avail: NTIS HC A02/MF A01 CSCL 10/2

Contents: Technical Problems; General Methodology; Technical Results; Implications for Further Research; Causes of Cell Degradation; Testing of Cells and Evaluation; and Back-up for Cell Fabrication and Assembly. GRA

N77-26695# Dow Chemical Co., Walnut Creek, Calif.
RESEARCH AND DEVELOPMENT OF THE GLASS FIBER SODIUM-SULFUR BATTERY Final Technical Report, 27 Mar. 1973 - 6 Oct. 1976
Charles Levine 6 Oct. 1976 52 p 2 Vol.
(Contract DAHC15-73-C-0254; ARPA Order 2381)
(AD-A037216) Avail: NTIS HC A04/MF A01 CSCL 10/2

Development work in the sodium-sulfur rechargeable cell which uses the walls of fine hollow glass fibers as the electrolyte has led to much longer lasting cells capable of thousands of deep and rapid cycles. The longest lived multifiber cell to date, cycling at over 90% depth, has undergone over 2,300 cycles in 92 days and is still in operation. This cell should be capable of over 220 watt hours per kg. Cell life is shortened by certain impurities in the Na, by nonfused tubesheets, and by fibers weakened during processing. Removal of these harmful effects is described, as well as problems in scaling up cell size, in developing a metal case for the cell, in thermal cycling, and in fabrication of the cell parts. Author (GRA)

N77-26696# Office of Naval Research, London (England).
INTERNATIONAL CONFERENCE ON HYDROGEN AND ITS PROSPECTS
W. G. Soper 31 Dec. 1976 23 p Conf. held at Liege, Belgium, 15-18 Nov. 1976
(AD-A036936; ONRL-C-49-76) Avail: NTIS HC A02/MF A01 CSCL 21/4

Papers from the international conference 'Hydrogen and its Prospects' Liege, Belgium, 15-18 1976, are reviewed for their contribution to future production and utilization of hydrogen as a fuel. Principal emphasis is placed upon the production of hydrogen by electrolysis and thermochemical decomposition of water, and upon the comparison of these processes with synthetic fuel production from fossil resources. Other topics discussed include hydrogen storage and its use as fuel in automobiles and aircraft. Author (GRA)

N77-26697# Illinois Univ., Urbana-Champaign. Center for Advanced Computation.
TECHNIQUES FOR THE ANALYSIS OF TOTAL ENERGY AND LABOR OF INDUSTRIAL PLANTS
Richard E. Klein, Hasan Sehitoglu, and Bruce M. Hannon May 1976 50 p refs
(Grant NSF SIA-72-03530)
(PB-264221/3; UIUC-CAC-DN-76-198; NSF/RA-760445) Avail: NTIS HC A03/MF A01 CSCL 10A

A method is developed for determination of the total energy (direct plus indirect) and the labor requirements to produce a unit of output from an industrial plant or facility. The total energy and labor requirements are determined by accounting for all energy and labor as the product or raw materials flow from the mine or other natural resource through all production and manufactures to a given production status. In this way, each manufacturing step is accounted for in its contribution to the total energy to produce a unit of product. GRA

N77-26698# National Academy of Sciences - National Research Council, Washington, D. C. Committee on Renewable Resources for Industrial Materials.
THE POTENTIAL OF LIGNOCELLULOSIC MATERIALS FOR THE PRODUCTION OF CHEMICALS, FUELS, AND ENERGY
1976 99 p refs
(Contract NSF STP-75-10169)
(PB-264458/1; NSF/PRA-7501069-4-7) Avail: NTIS HC A05/MF A01 CSCL 07A

An energy policy is analyzed. For conservation of energy and materials the logical sequence of approaches to obtaining chemicals and polymers from lignocellulose is suggested as follows: (1) recovery of lignocellulosic chemicals from waste existing manufacturing operations now using these materials for other uses and from urban and agricultural solid waste, (2) conversion of cellulose, lignin and hemicelluloses and their derivatives into useful products taking advantage of their existing polymeric structure, and (3) conversion of cellulose, lignin and hemicelluloses into chemical intermediates which can be reassembled into useful polymers. GRA

N77-26699# National Academy of Sciences - National Research Council, Washington, D. C. Committee on Renewable Resources for Industrial Materials.
EXTRACTIVES AS A RENEWABLE RESOURCE FOR INDUSTRIAL MATERIALS
James S. Bethel 1976 74 p refs
(Contract NSF STP-75-01069)
(PB-264459/9; NSF/PRA-7501069-5-7) Avail: NTIS HC A04/MF A01 CSCL 07A

Extractives from plants and animals are used to varying degrees in manufacturing processes of industrial goods. Bark, oleoresin, waxes, oils and fats, and tallow are covered. These products are derived from forest, agricultural and marine sources. Consideration of the energy requirements and environmental impacts associated with the implementation of the recommendations are included in this report. GRA

N77-26700# Eagle-Picher Co., Joplin, Mo. Couples Dept.
REPORT FOR BA 494/U
D. H. Spracklen 12 Nov. 1976 31 p refs
(DAHC60-72-C-0053)
(AD-A035722; Rept-4212-T-1176) Avail: NTIS HC A03/MF A01 CSCL 10/3

This report covers the testing of two randomly chosen batteries from Lot 22 which have been stored for 54 months at 120 F. The failure of some specimens to maintain 14.0 volts after ground power cut-off is discussed in this report. It also contains Discharge Data Sheets, Activation Traces, curves showing X trends for Rise Time and Capacity, and summaries. This report also includes information concerning testing of two batteries stored 9 years, one at room temperature and at 110 F, along with accumulated data from Lot 19. These batteries performed well. Author (GRA)

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N77-26701*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IN SITU MEASUREMENTS OF ARCTIC ATMOSPHERIC TRACE CONSTITUENTS FROM AN AIRCRAFT
Gregory M. Reck, Daniel Briehl, and Ted W. Nyland Washington Jun. 1977 64 p refs
(NASA-TN-D-8491; E-9040) Avail: NTIS HC A04/MF A01 CSCL 13B

In situ measurements of the ambient concentrations of several atmospheric trace constituents were obtained using instruments installed on board the NASA Convair 990 aircraft at altitudes up to 12.5 kilometers over Alaska and the Arctic Ocean. Concentration data on ozone, carbon monoxide, water vapor, and particles larger than 0.5 micrometer in diameter were acquired. Author

N77-26702*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
JUDGEMENTS OF RELATIVE NOISINESS OF A SUPERSONIC TRANSPORT AND SEVERAL COMMERCIAL-SERVICE AIRCRAFT
Clemans A. Powell Washington Jun. 1977 56 p refs
(NASA-TN-D-8434) Avail: NTIS HC A04/MF A01 CSCL 20A

Two laboratory experiments were conducted on the relative noisiness of takeoff and landing operations of a supersonic transport and several other aircraft in current commercial service. A total of 96 subjects made noisiness judgments on 120 tape-recorded flyover noises in the outdoor-acoustic-simulation experiment; 32 different subjects made judgments on the noises in the indoor-acoustic-simulation experiment. The judgments were made by using the method of numerical category scaling. The effective perceived noise level underestimated the noisiness of the supersonic transport by 3.5 db. For takeoff operations, no difference was found between the noisiness of the supersonic transport and the group of other aircraft for the A-weighted rating scale; however, for landing operations, the noisiness of the supersonic transport was overestimated by 3.7 db. Very high correlation was found between the outdoor-simulation experiment and the indoor-simulation experiment. Author

N77-26703# Los Alamos Scientific Lab., N. Mex.
AEROSOL RESEARCH AND DEVELOPMENT RELATED TO HEALTH HAZARDS ANALYSIS Technical Report, 1 Jul. 1975 - 30 Jun. 1976
Lawrence W. Ortiz and Charles I. Fairchild Oct. 1976 21 p refs
(Contract W-7405-ENG-36; NIOSH-Proj. R072)
(LA-6539-PR) Avail: NTIS HC A02/MF A01

The particulate filtration efficiency of industrial gas-vapor sampler tubes was determined. This filtration efficiency is of interest for work environments containing toxic vapors and particulates of the contaminant, or inert particles containing adsorbed contaminant. The sampler tubes collect from 70-90 percent of the particles entering, but only 20 percent of the total is deposited on the active sorbent (charcoal granules). Considerable variability in collection efficiency between tubes was observed. Recommendations are made for obtaining improved contaminant estimates using these tubes. The preliminary design of a real-time particle sizing sampler for use in coal mines is described. ERA

N77-26704# Battelle Pacific Northwest Labs., Richland, Wash.
DIRECT-INLET MASS SPECTROMETER FOR REAL-TIME ANALYSIS OF PARTICULATE CONTAMINANTS IN AIR
J. J. Stoffels and C. R. Lagergren 25 Jun. 1976 12 p refs Presented at 7th Intern. Mass Spectrometry Conf., Florence, Italy, 30 Aug. 1976
(Contract E(45-1)-1830)
(BNWL-SA-5645; Conf-760852-1) Avail: NTIS HC A02/MF A01

A direct-inlet mass spectrometer developed for use in air pollution research is described. Goals of the development effort which were achieved include: an air inlet with a large effective sampling capacity; a dispersive mass analyzer to permit future simultaneous measurement of multiple ion beams; a detector which can measure the ion current due to airborne particles within a three-decade range of physical diameter; and a complete instrument which is small enough to be transported to different sites. ERA

N77-26705# Stanford Univ., Calif. Dept. of Statistics.
MAXIMA OF PARTIAL SAMPLES IN GAUSSIAN SEQUENCES
Yashaswini Mittal 1 Aug. 1976 25 p refs
(Contract EY-76-S-02-2874)
(COO-2874-3; TR-3) Avail: NTIS HC A02/MF A01

Air pollution standards are generally in terms of the maximum concentrations. Various practical difficulties (cost of sampling or missing data) are at times responsible for having only a partial sample available for making inferences. The behavior of the difference of two maxima considered here can thus be used to retract information about the original maximum via the maximum of only a partial sample. ERA

N77-26706# Battelle Pacific Northwest Labs., Richland, Wash. Dept. of Atmospheric Sciences.
COMPREHENSIVE AEROSOL GROWTH MODEL
Ronald L. Drake 2 Aug. 1976 6 p Presented at Topical Meeting of the Optical Soc. of Am., Williamsburg, Va., 13-15 Dec. 1976
(Contract E(45-1)-1830)
(BNWL-SA-5931; Conf-761202-2) Avail: NTIS HC A02/MF A01

The aerosol component of a user-oriented computer code that was formulated to solve the general equations of continuity for trace substances in the atmosphere is described. ERA

N77-26707# Argonne National Lab., Ill.
URBAN DESIGN AND PUBLIC EXPOSURE TO CARBON MONOXIDE
Danilo Santini Oct. 1976 10 p
(Contract W-31-109-eng-38; Grants NSF AG-352; NSF GI-3289A2)
(ANL-76-XX-22) Avail: NTIS HC A02/MF A01

Ways to reduce risk of exposure by the physical design of new downtown residential developments are examined. The concept is not a novel one, having been successfully implemented in industry to provide occupational health and safety. ERA

N77-26708# Argonne National Lab., Ill.
AIR POLLUTION AND THE SITING OF FOSSIL FUEL POWER PLANTS
Gideon Fishelson, Gordon C. Rausser, and Alan S. Cohen Jul. 1976 12 p Prepared in cooperation with Chicago Univ., Ill.
(Contract W-31-109-eng-38; Grants NSF AG-352; NSF GI-32989-Az)
(ANL-76-XX-14) Avail: NTIS HC A02/MF A01

An analysis of the total social cost, and the trade-offs between generation/transmission and air pollution costs, for various types of fossil plants at different sites in northern Illinois are presented. The analysis identifies the combinations of site, fossil fuel, and sulfur dioxide (SO2) control technology that minimize total social costs. ERA

N77-26709# Stanford Univ., Calif. Dept. of Statistics.
ROBUSTNESS OF LINEAR ESTIMATORS TO MIS-

SPECIFICATION OF TREND
Ruth Sheshinski 16 Aug. 1976 28 p refs Sponsored in part by Siam Inst. for Math.
(Contract EY-76-S-02-2874)
(COO-2874-4; TR-4) Avail: NTIS HC A03/MF A01

Air pollution concentrations over an air basin, is examined using a model of a spatially autocorrelated random process. Estimators based on an unspecified constant mean, and estimations done with specified linear trend function to estimation with an unspecified linear trend function are compared. A biased partially constrained estimator versus a fully constrained universally unbiased estimator in the presence of a linear trend is presented. ERA

N77-26710# Stanford Univ., Calif. Dept. of Statistics.
INTERPOLATION OF AIR POLLUTION: A STOCHASTIC APPROACH
Ray Faith 1 Nov. 1976 8 p refs
(Contract EY-76-S-02-2874)
(COO-2874-11; Working Paper 5) Avail: NTIS HC A02/MF A01

The method requires for its application knowledge of the spatial convariance structure of the pollutant to which it is applied. Some difficulties encountered in estimating this for oxidant levels in the San Francisco Bay Area are mentioned. ERA

N77-26711# Oak Ridge National Lab., Tenn.
SHORT- AND LONG-TERM DISPERSION FACTORS FOR CALCULATING THE ENVIRONMENTAL BURDEN DUE TO EXHAUST AIR STREAMS
K. J. Vogt, H. Geiss, and E. Voelz 1974 43 p refs Transl. into ENGLISH from West Ger. report, ZST-198
(ORNL-TR-4234; ZST-198) Avail: NTIS HC A03/MF A01

The distribution of ground-level concentration is measured with about 100 sampling stations for various weather conditions and different altitudes of emission (50 and 100 m). The results show that the maxima of the ground-level concentration in comparison to the Pasquill prognostics, depending on the diffusion category, are located closer to the source by a factor of 2 to 5, whereby the absolute value of the concentration at the maximum is underestimated by a factor of 2. This discrepancy may be explained by the fact that, in determining the diffusion categories by the method based on synoptic observations, the differing irregularities of the terrain are not taken into consideration. Statistical studies are being made in order to determine the relation between the dispersion parameters measured in experiments as well as stability parameters such as, for example, the Richardson number. In addition, studies are being conducted on the determination of the ground roughness parameters. The results are used in calculating the environmental burden from emitters of harmful substances. ERA

N77-26712# Oak Ridge National Lab., Tenn.
COMPARISON OF CALCULATED AND MEASURED MAXIMUM ABOVEGROUND AIR POLLUTANT CONCENTRATIONS AND THEIR RESPECTIVE DISTANCES FROM THE SOURCE OF RELEASE OF LARGE POWER PLANTS
Heinz Fortak Dec. 1969 18 p refs Transl. into ENGLISH from Staub-Reinhalt. Luft (Duesseldorf), v. 29, no. 12, Dec. 1969 p 493-498
(ORNL-TR-4231) Avail: NTIS HC A02/MF A01

A simplified version of the theory of atmospheric diffusion is applied to simulate maximum ground-level SO2 concentrations measured near large fossil fuel power plants. The results depend strongly on the special form of the plume rise formula. Neither Csanady's original formula nor the new optimized version of it gives satisfactory results. A slight modification of the exponent in the optimized Csanady-formula however seems to simulate the measurements in the best way. ERA

N77-26713# Brookhaven National Lab., Upton, N.Y.
OXIDATION OF SULFUR DIOXIDE IN POWER PLANT PLUMES
J. Forrest and Leonard Newman 1976 31 p refs Presented at the 69th Ann. Meeting of the AICHE, Chicago, 28 Nov. 1976
(Contract E(30-1)-16; EPA-IAG-D4-0391)
(BNL-21698; Conf-761109-5) Avail: NTIS HC A03/MF A01

The extent of oxidation of sulfur dioxide to sulfate was measured at two coal-fired and four oil-fired power plant plumes. Samples were collected at various distances downwind of the source by employing a high-volume filter pack in a fixed-wing aircraft. Particulate sulfur to total sulfur concentration ratios and S-34 to S-32 isotope ratios were measured and interpreted. In almost all instances essentially all of the oxidation was found to occur during the first few kilometers of plume transit and even when plumes were followed for more than 70 kilometers. In the coal-fired plumes the extent of oxidation seldom exceeded 4 percent, one-third of which could be attributed to primary sulfate production during the combustion of the coal. In the oil-fired plumes the extent of oxidation was approximately twice that observed for coal. ERA

N77-26714# TRW Systems Group, Redondo Beach, Calif.
MEASUREMENT TECHNIQUES FOR INORGANIC TRACE MATERIALS IN CONTROL SYSTEM STREAMS Final Report, Jan. 1974 - Jun. 1975
J. A. Starkovich, R. F. Maddalone, M. L. Kraft, C. Zee, and C. Lin Dec. 1976 146 p refs
(Contract EPA-68-02-1393)
(PB-264345/0; EPA-600/2-76-283) Avail: NTIS HC A07/MF A01 CSCL 07D

A modified high-volume sampling train provides adequate size samples in a 1 to 2 hour sampling period for determining inorganic elements present in gas source streams at 60 micrograms/cu m(1.1 x 10 to the minus 7th power gr/scf) and higher levels. The train's collection efficiency at sampling rates from 0.6 cu m/min (2 scfm) to 0.14 cu m/min (5 scfm) is greater than 95% for all elements analyzed (e.g., Hg, Li, Zn, Pb). Procedures and equipment currently in use for sampling liquids, slurries, and solids for major constituents are accurate and reliable for sampling trace materials. GRA

N77-26715# GCA Corp., Bedford, Mass. GCA Technology Div.
NATIONAL ASSESSMENT OF THE URBAN PARTICULATE PROBLEM. VOLUME 1: SUMMARY OF NATIONAL ASSESSMENT Final Report
David A. Lynn, Gordon L. Deane, Rebecca C. Galkiewicz, and Robert M. Bradway Jul. 1976 357 p refs
(Contract EPA-68-02-1376)
(PB-263665/2; GCA-TR-76-25-G(1); EPA-450/3-76-024)
Avail: NTIS HC A16/MF A01 CSCL 13B

Numerous urban areas were studied to determine the reasons for attainment or nonattainment of the National Ambient Air Quality Standards. The data from the particle characterization and urban area reports were combined to provide a national assessment of the problem. Three major factors affecting attainment were evaluated and listed as follows; (1) large scale effects from transported primary and secondary particulates; (2) traditional sources such as fuel combination, industrial process and solid waste; and (3) nontraditional sources such as mobile source exhaust, tire rubber, construction, paved and unpaved roads, etc. Two factors which modify measured levels, meteorology and monitor siting, are also examined. Author

N77-26716# GCA Corp., Bedford, Mass. GCA Technology Div.
NATIONAL ASSESSMENT OF THE URBAN PARTICULATE PROBLEM. VOLUME 2: PARTICLE CHARACTERIZATION Final Report
Robert M. Bradway and Frank A. Record Jul. 1976 281 p refs
(Contract EPA-68-02-1376)
(PB-263666/0; GCA-TR-76-25-G(2); EPA-450/3-76-025)
Avail: NTIS HC A13/MF A01 CSCL 13B

The results of analyses that were undertaken in an effort to characterize the various components and types of particles that comprise ambient suspended paticulate matter are presented. Most of the information was obtained by optical microscopic analysis of filter segments. A quality control program in the form of blind replicate analysis was utilized and a statistical analysis of the results is also reported. GRA

N77-26717# Environmental Sciences Research Lab., Research Triangle Park, N.C.

INTERNATIONAL CONFERENCE ON PHOTOCHEMICAL OXIDANT POLLUTION AND ITS CONTROL. PROCEEDINGS, VOLUME 1

Basil Dimitriades, ed. Jan. 1977 564 p refs Proc. held at Raleigh, N. C., 12-17 Sep. 1976 Prepared in cooperation with Triangle Universities Consortium on Air Pollution, Chapel Hill, N. C. 2 Vol.

(PB-264232/0; EPA-600/3-77-001a-Vol-1) Avail: NTIS HC A24/MF A01 CSCL 07E

Technical papers covering the following areas are presented: analytical methods for oxidants and precursors; sources of tropospheric ozone; ozone/oxidant transport; impact of stratospheric ozone; theories on rural ozone/oxidates; and physiological effects of oxidants. GRA

N77-26718# Environmental Sciences Research Lab., Research Triangle Park, N.C.

INTERNATIONAL CONFERENCE ON PHOTOCHEMICAL OXIDANT POLLUTION AND ITS CONTROL. PROCEEDINGS, VOLUME 2

Basil Dimitriades, ed. Jan. 1977 566 p refs Proc. held at Raleigh, N. C., 12-17 Sep. 1976 Prepared in cooperation with Triangle Universities Consortium on Air Pollution, Chapel Hill, N. C. 2 Vol.

(PB-264233/8; EPA-600/3-77-001b-Vol-2) Avail: NTIS HC A24/MF A01 CSCL 07E

Technical papers covering the following areas are presented: physiological effects of oxidants; effects of oxidants on vegetation; reactivity and its use in oxidant-related control; atmospheric chemistry and physics; mathematical models of ozone/oxidant air quality; oxidant-precursor relationships and their interpretation in terms of optimum strategy for oxidant control; control of oxidant precursor emissions; air quality and emission trends; and the ozone/oxidant control strategy in U.S. GRA

N77-26719# California State Dept. of Health, Berkeley. Air and Industrial Hygiene Lab.

COMPARISON OF WET CHEMICAL AND INSTRUMENTAL METHODS FOR MEASURING AIRBORNE SULFATE Interim Report, 22 Jun. 1974 - 22 Aug. 1975

B. R. Appel, E. M. Hoffer, and J. J. Wesolowski Mar. 1976 145 p refs

(Contract EPA-68-02-1660)

(PB-264201/5; EPA-600/2-76-059) Avail: NTIS HC A07/MF A01 CSCL 07D

Four techniques for determination of water soluble sulfate in atmospheric samples were compared. The parameters studied included precision and accuracy employing standard solution and ambient air samples, and the influence of twelve potential interferents. The ambient air samples studied were collected at different locations throughout the U.S. so that the influence of different matrices could be evaluated. GRA

N77-26720# GCA Corp., Bedford, Mass. Technology Div.

IMPROVEMENTS TO SINGLE-SOURCE MODEL. VOLUME 1: TIME-CONCENTRATION RELATIONSHIPS

Michael T. Mills and Roger W. Stern Jan. 1977 57 p refs

(Contract EPA-68-02-1376)

(PB-264686/7; EPA-450/3-77-003a) Avail: NTIS HC A04/MF A01 CSCL 13B

The effect upon ratio distribution statistics was examined for the case where only peak concentrations above a certain cutoff value were analyzed. The plant site characteristics and the meteorological and air quality data bases are described. This is followed by a discussion of the ratio distributions and their associated statistics, including an analysis of the variation of these parameters for different plant sites and peak concentration cutoffs. The report concludes with a discussion regarding the general applicability of these results to other point sources. GRA

N77-26721# Monsanto Research Corp., Dayton, Ohio.

PARTICULATE CONTROL MOBILE TEST UNITS: SECOND YEAR'S OPERATION Progress Report, Jul. 1975 - Jun. 1976

D. L Zanders Jan. 1977 41 p refs

(Contract EPA-68-02-1816)

(PB-264067/0; MRC-DA-578; EPA-600/2-77-042) Avail: NTIS HC A03/MF A01 CSCL 07A

Results from baghouse tests on a kraft mill lime recovery kiln indicate an overall, integrated collection efficiency of 99.98+ wt%. Based on collection efficiency alone, a high level of control can be afforded by a baghouse on lime kiln particulate emissions. However, based on projected operating problems due to high moisture content of the gas, baghouse control of a lime recovery kiln is not recommended. Mobile scrubber unit operation was confined to startup field testing and correction of mechanical and operating difficulties. GRA

N77-26722# National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Resources Labs.

A DIFFUSION-DEPOSITION SCHEME FOR USE WITHIN THE ARL TRAJECTORY MODEL

Roland R. Draxler Dec. 1976 25 p refs

(PB-264788/1; NOAA-TM-ERL-ARL-63; NOAA-77021401) Avail: NTIS HC A02/MF A01 CSCL 13B

A finite difference method for vertical diffusion and deposition has been developed and incorporated into the existing trajectory model. The finite difference multi-box model permits temporal variations of vertical diffusivity profiles and deposition parameters. The multi-box model is presented including some examples of its application to Lagrangian trajectories with respect to dry deposition and diurnal stability changes. GRA

N77-26723# Southern Illinois Univ., Edwardsville.

TECHNICAL AND ECONOMIC EVALUATION OF NOx CONTROL FOR COAL-FIRED CYCLONE FURNACES Final Report

Kenneth E. Noll Nov. 1976 50 p refs Sponsored by Illinois Inst. for Environmental Quality

(PB-264642/0; IIEQ-76-26) Avail: NTIS HC A03/MF A01 CSCL 13B

Air pollution control techniques are presented. The study covers the description of the project at Southern Illinois Power Cooperative, Marion, Illinois; information on control alternatives; cost of NOx control; and environmental benefit considerations. GRA

N77-26724# Texas Transportation Inst., College Station.

ANALYTICAL AND EXPERIMENTAL ASSESSMENT OF HIGHWAY IMPACT ON AIR QUALITY

J. A. Bullin and J. C. Polasek 18 Aug. 1976 127 p refs Sponsored by DOT and Texas State Dept. of Highways and Public Transportation

(PB-264590/1; TTI-2-8-75-218; RR-218-1; FHWA-TX-75-218) Avail: NTIS HC A07/MF A01 CSCL 13B

Air quality measurements along Houston freeways are used to characterize carbon monoxide concentrations downwind from highway line sources. Measurements at each site consisted of carbon monoxide concentrations at 10 locations, vehicle length, speed and count by lane, and detailed meteorological data from four stations between five and 101.5 feet. All of the instruments were interfaced to a Data General Nova 1200 computer which allows the data to be taken simultaneously and on a rapid time basis. Experimental data from essentially all previous experimental programs have been assembled and used in developing and verifying an improved roadway dispersion model. GRA

N77-26725# State Univ. of New York, Albany. Atmospheric Sciences Research Center.

MEASUREMENTS OF BACKGROUND HYDROCARBONS IN REMOTE AREAS

Robert Whitby (N. Y. State Dept. of Environ. Conserv.), Roland Luther, Mohnen Volker, and Peter Coffey (N. Y. State Dept. of Environ. Conserv.) 12 Nov. 1976 21 p refs Presented at Symp. on Non-Urban Tropospheric Composition, Hollywood, Fla., 10-12 Nov. 1976

(Contract N00014-76-C-0283)

(AD-A037361) Avail: NTIS HC A02/MF A01 CSCL 06/1

Volatile terpene, ozone, and condensation nuclei concentrations have been measured at a remote site in the Adirondack Mountains of New York State. Measurements were taken in a conifer forest, downwind of a conifer forest, and on a mountain summit above the tree line. A wide variety of organic species were found. Some observations and speculations about the relationships among the organic species, condensation nuclei, and ozone are made. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N77-26726*# Kanner (Leo) Associates, Redwood City, Calif.
RESULTS OF UHF RADIOMETRIC AND DIRECT GROUND MEASUREMENTS OF SOIL MOISTURE IN 1975
A. Ye. Basharinov, B. M. Liberman, Ye. A. Peutov, A. A. Chukhlantsev, and A. M. Shutko Washington NASA Feb. 1977 21 p refs Transl. into ENGLISH of Russian report from Academy of Sciences USSR (Moscow), 1976 23 p
(Contract NASw-2790)
(NASA-TT-F-17521) Avail: NTIS HC A02/MF A01 CSCL 08M

Measurement results are presented in figures and tables, and they are discussed. It was found that there is good correlation between radiating power at 18 cm and bulk soil moisture in the 0-30 cm layer, that the presence of cotton plants up to 1 m high causes no more than 20% error in the UHF (Ultrahigh Frequencies) measurements, that it is possible to measure up to 10 gradations of moisture content of both open and planted soil by 18 cm UHF radiometry, and that good correlation between moisture content of adjacent soil layers permits estimation of the moisture reserve up to 1 m deep from UHF radiometric measurements. Author

N77-26727*# Illinois Univ., Urbana. Aeronomy Lab.
RESEARCH IN AERONOMY Progress Report, 1 Apr. - 30 Sep. 1976
Belva Edwards, ed. 30 Sep. 1976 138 p refs
(Grants NGR-14-005-181; NSF ATM-73-06485; NSF ATM-75-15523; NSF ATM-76-01773)
(NASA-CR-153264; PR-76-2) Avail: NTIS HC A07/MF A01 CSCL 04A

Summaries of work performed by each working group are presented. These summaries have been written as a part of the groups' activities. Author

N77-26728*# Lamont-Doherty Geological Observatory, Palisades, N. Y.
RESURVEY OF SITE STABILITY QUADRILATERALS, OTAY MOUNTAIN AND QUINCY, CALIFORNIA Supplementary Report
C. H. Scholz Jul. 1977 8 p ref
(Grant NGR-33-008-146)
(NASA-CR-149155) Avail: NTIS HC A02/MF A01 CSCL 08E

Trilateration quadrilaterals established across two faults near the San Andreas Fault Experiment laser/satellite ranging sites were resurveyed after four years. No evidence of significant tectonic motion was found. Author

N77-26729*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SUMMARY OF LIGHTNING ACTIVITIES BY NASA FOR THE APOLLO SOYUZ TEST PROJECT: SUPPLEMENT NO. 1 TO APOLLO SOYUZ MISSION EVALUATION REPORT
Jul. 1976 38 p
(NASA-TM-74755; JSC-10607-Suppl-1) Avail: NTIS HC A03/MF A01 CSCL 04A

To avoid the possibility of an unnecessary launch delay, a special program was initiated to provide aircraft measurement of electric fields at various altitudes over the Apollo vehicle launch pad. Eight aircraft, each equipped with electric field meters, were used in the program. This program and some of the more important findings are discussed. Also included is a summary of the history of manned space vehicle involvement with lightning, a brief description of the lightning instrumentation in use at KSC (Kennedy Space Center) at the time of the Apollo Soyuz mission and a discussion of the airborne instrumentation and related data. Author

N77-26730*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.
AN EXPERIMENTAL STUDY OF THE ATMOSPHERIC BOUNDARY LAYER MODIFIED BY A CHANGE IN SURFACE ROUGHNESS AND SURFACE TEMPERATURE
H. W. Tieleman and D. B. Derrington, Jr. May 1977 147 p refs
(Grant NGL-47-004-67)
(NASA-CR-141422; VPI-E-77-17) Avail: NTIS HC A07/MF A01 CSCL 04A

Turbulent flow, resembling an on-shore flow from the ocean crossing the beach at an oblique angle, is investigated. Measurements of this flow have been taken at high sample rates and include measurements at various heights, high enough to describe the portion of the mean wind and temperature profiles and fluxes that are of interest for the solution of practical engineering problems. These problems could include air pollution (fumigation and plume trapping), operation of low flying aircraft, crop-spraying and crop-dusting operations. Author

N77-26731# Weston Observatory, Mass.
INVESTIGATION OF MAGNETIC FIELD PHENOMENA IN THE IONOSPHERE Final Report, 1 Aug. 1973 - 30 Jun. 1976
John F. Devane, Robert Dalrymple, and Edward Johnson Sep. 1976 37 p refs
(Contract F19628-74-C-0003)
(AD-A037541; AFGL-TR-76-0230) Avail: NTIS HC A03/MF A01 CSCL 08/14

Weston Observatory (Boston College) has maintained a geomagnetic observatory to continuously monitor changes in the geomagnetic field and to provide standards for magnetic instrumentation as well as a coil system in which a wide variety of magnetic instrumentation has been tested and calibrated to support AFGL testing and installation of portions of a magnetometer network for the collection and digital transmission of magnetic activity data to Bedford, Mass. The observatories are at approximately 55 deg N corrected geomagnetic latitude on sites from Massachusetts to the State of Washington. There are detailed engineering drawings of the sites, the instrumentation shelters and the instrumentation vans. Some problems with the instrumentation and their solutions are described. Author (GRA)

N77-26732*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
AEROSOL PHYSICAL PROPERTIES IN THE STRATOSPHERE (APPS) RADIOMETER DESIGN
C. R. Gray, E. Albert Woodin, Thomas J. Anderson, Robert J. Magee, and George W. Karthas Jan. 1977 245 p refs
(Contract NAS1-14150)
(NASA-CR-145199; R-1031) Avail: NTIS HC A11/MF A01 CSCL 04A

The measurement concepts and radiometer design developed to obtain earth-limb spectral radiance measurements for the Aerosol Physical Properties in the Stratosphere (APPS) measurement program are presented. The measurements made by a radiometer of this design can be inverted to yield vertical profiles of Rayleigh scatterers, ozone, nitrogen dioxide, aerosol extinction, and aerosol physical properties, including a Junge size-distribution parameter, and a real and imaginary index of refraction. The radiometer design provides the capacity for remote sensing of stratospheric constituents from space on platforms such as the space shuttle and satellites, and therefore provides for global measurements on a daily basis. Author

N77-26733# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
CAVITY DETECTION BY MEANS OF SEISMIC SHEAR AND COMPRESSIONAL WAVE REFRACTION TECHNIQUES Final Report, 30 Jun. 1975 - 31 Jan. 1976
Roger M. Turpening Jun. 1976 108 p refs
(Contract E(29-2)-3614)
(TID-27225; Rept-116400-1-F) Avail: NTIS HC A06/MF A01

Seismic shear waves can be generated with sufficient strength to be usable in refraction profiles out to a distance of 1,800 ft under high seismic noise conditions. Over a known anomalous zone (cavity or cavity plus roof fall zone) large reductions in shear wave amplitudes were observed. Compressional waves, this experiment, were generated by two different sources. First the shear wave generator was elevated and used to generate

compressional waves, and surface explosions were used. The compressional waves by the first method were weak. The explosion produced compresssional waves, displayed good signal-to-noise ratio, and showed no amplitude variation over the cavity area. A crude mapping of the 'true' position of the anomalous zone from the apparent position along each profile yields an internally consistent closure. The method can be applied for permanent continuous monitoring of in situ cavity formation including the upward migration of the roof fall zone. ERA

N77-26734# Los Alamos Scientific Lab., N. Mex.
EVOLUTION OF SILICIC MAGMA CHAMBERS AND THEIR RELATIONSHIP TO BASALTIC VOLCANISM
John C. Eichelberger and R. Gooley 1976 35 p refs Presented at the Symp. on the Crust, Vail, Colo., 2-6 Aug. 1976; sponsored by ONR and the Colo. School of Mines
(Contract W-7405-eng-36)
(LA-UR-76-1708; Conf-760872-1) Avail: NTIS HC A03/MF A01

Phase assemblages in volcanic rocks and bulk composition of volcanic and plutonic rocks in sites of this type show that much of the variation in erupted or crystallized end products is due to this interaction of basaltic and rhyolitic magmas. It is proposed that basalt magma from the upper mantle provides heat for generating rhyolitic melt in the lower crust, and that the resulting rhyolite magma body continues to receive injections of basalt as it rises through the crust. Implications of this model are discussed. ERA

N77-26735# Oak Ridge National Lab., Tenn.
METHOD FOR DETERMINING ATMOSPHERIC DISPERSION CONDITIONS FROM SYNOPTIC OBSERVATIONS
Werner Klug Apr. 1969 13 p refs Transl. into ENGLISH from Staub-Reinhalt. Luft (West Ger.), v. 29, no. 4, Apr. 1969 p 143-147 Sponsored by ERDA
(ORNL-TR-4230) Avail: NTIS HC A02/MF A01

Measures taken in the area of maintenance of pure air frequently require knowledge of the climatological distribution of atmospheric dispersion conditions in a certain locality. A climatological distribution of the dispersion conditions would be relatively easily obtained if long-term measurements of turbulence were available for the locality at which the distribution is needed. Such turbulence measurements, however, have been made at only a few places and then only as spot checks. For this reason, a correlation between easily obtainable meteorological data and atmospheric dispersion conditions is of considerable practical importance. The most useful would be one which permits making conclusions as to atmospheric dispersion conditions from the data of a synoptic observation. The correlation scheme should also be objectively programmable and hence progammable for data processing installations. Such a correlation scheme is also applicable to the calculation of actual concentration fields. ERA

N77-26736# Brookhaven National Lab., Upton, N.Y. Dept. of Applied Science.
LIMITATION ON ELECTRICAL MEASURES OF AEROSOLS
W. H. Marlow 1976 12 p refs Presented at 8th Mater. Res. Symp., Gaithersburg, Md., 20 Sep. 1976
(Contract EY-76-C-02-0016)
(BNL-21946; Conf-760985-1) Avail: NTIS HC A02/MF A01

Atmospheric conductivity is used as a measure of the presence of aerosol particles because such particles remove the effective charge carriers from the atmosphere. Another variety of electrical measure is the total charge acquired by the aerosol under either natural or artificial charging conditions. Currently, the most widely cited electrical method for aerosol size distribution analysis is the diffusion charging mobility analysis method in which the electrical current due to the controlled unipolar charging of the aerosol is measured while increasing mobility fractions of that aerosol are removed. The hypothesis is that by monitoring the diminution of aerosol current as a function of the known particle electrical mobilities removed, a measure of the aerosol size distribution is derived. Fundamental to all such measures of aerosol size is the assumption that any aerosol can be put in a well-defined charge state. ERA

N77-26737# Battelle Pacific Northwest Labs., Richland, Wash.
CONVERSION OF TRITIATED HYDROGEN TO WATER IN THE ATMOSPHERE
L. L. Burger Sep. 1976 47 p refs
(Contract E(45-1)-1830)
(BNWL-2113) Avail: NTIS HC A02/MF A01

The global distribution of hydrogen and of water is first considered. Data on tritium distribution are then compared and, finally, known reactions which may convert tritiated hydrogen-containing molecules are discussed. Photochemical oxidation may be the predominant conversion mechanism and over larger periods of time may combine with bacterial action to serve as the principal pathways of conversion of HT (or T2) and CH3T to HTO or other more reactive forms of tritium. The net conversion rate following a tritium release to the atmosphere would be expected to be less than 1 percent in 24 hr. The significance of the relatively high tritium content in atmospheric methane needs evaluation. Monitoring of CH3T has been largely neglected in the past. Considerable uncertainty exists in some of the data on which these conclusions are based, and recommendations are made for further work. ERA

N77-26738# Denver Univ., Colo. Dept. of Physics and Astronomy.
WATER VAPOR, NITRIC ACID AND OZONE MIXING RATIO HEIGHT PROFILES DERIVED FROM SPECTRAL RADIOMETRIC MEASUREMENTS
David G. Murcray, James N. Brooks, Aaron Goldman, John J. Kosters, and W. John Williams Feb. 1977 145 p refs Supersedes BRL-IMR-267 and BRL-IMR-361
(Contract DAAD05-74-C-0795)
(AD-A037375; BRL-CR-332; BRL-IMR-267; BRL-IMR-361) Avail: NTIS HC A07/MF A01 CSCL 04/1

Two balloon flights of 27 June 1974 and 19 February 1975 are reported here. The LHe spectral radiometer which was developed for these flights is described in detail. The calibration and data reduction procedures are also described in detail. Plots of spectral radiance at various altitudes up to 38 km are shown. Finally mixing ratio height profiles derived from this data for H2O, HNO3, and O3 are calculated. Author (GRA)

N77-26739*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
CORRELATED ELECTRIC FIELD AND LOW-ENERGY ELECTRON MEASUREMENTS IN THE LOW-ALTITUDE POLAR CUSP Progress Report
P. M. Kintner, K. L. Ackerson, D. A. Gurnett, and L. A. Frank Dec. 1976 34 p refs Submitted for publication
(Contract NAS1-13129; Grants NGL-16-001-043; NGL-16-001-002; N00014-76-C-0016)
(NASA-CR-152863; AD-A037305; U-of-Iowa-76-34) Avail: NTIS HC A03/MF A01 CSCL 04/1

Correlated electric field and low-energy electron measurements are presented for two passes of Hawkeye 1 through the south polar cusp at 2,000 km altitude during local morning. In one case the electric field reversal coincides with the boundary of detectable 5.2-keV electron intensities and the equatorward boundary of the cusp. In the other case the electric field reversal and the 5.2-keV electron trapping boundary coincide but the equatorward edge of the cusp as determined from the presence of 180-eV electron intensities is 5 deg invariant latitude equatorward of the electric field reversal. We conclude that in the second case electron intensities associated with the polar cusp populate closed dayside field lines, and hence the corresponding equatorward edge of these electron intensities is not always an indicator of the boundary between closed dayside field lines and polar cap field lines. Author (GRA)

N77-26740# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
MAGNETOSPHERIC MAGNETIC FIELD MODELING Annual Report
W. P. Olson and K. A. Pfitzer Jan. 1977 103 p refs
(Contract F44620-75-C-0033; AF Proj. 9751)
(AD-A037492; AFOSR-77-0156TR) Avail: NTIS HC A06/MF A01 CSCL 04/1

A quantitative model of the magnetospheric magnetic field and associated procedures for accurately cataloging charge particle data out to and beyond geosynchronous orbit is developed. The magnetic field model incorporates all major magnetospheric

current systems and is valid for all tilt angles; i.e., angles of incidence of the solar wind on the dipole axis. The model accurately represents the total magnetospheric magnetic field for conditions of low magnetic activity and to a geocentric distance of 15 earth radii or to the magnetopause. A new (B, I) coordinate system is developed to more accurately organize charged particle data. The electric field produced by the daily varying tilt angle is computed. Author (GRA)

N77-26741# General Electric Co., Philadelphia, Pa. Space Div.

ATMOSPHERIC CLOUD PHYSICS LABORATORY (ACPL) OPTICAL MOTION CONTROL STUDY Final Report

Larry R. Eaton and Sherman L. Neste Jan. 1977 58 p refs
(Contract N00014-76-C-1057)
(AD-A037250) Avail: NTIS HC A04/MF A01 CSCL 04/1

The concept of utilizing optical energy (radiation pressure) to provide motion control and stability for water droplets in the size range applicable to atmospheric cloud physics (5-100 micrometers) is investigated. It is shown that the inherent stabilizing forces of a Gaussian laser beam (TEM00) together with the beam's ability to manipulate individual particles make a powerful tool for studying droplet or ice crystal growth and for initiating relative droplet motion in order to investigate various collision/coalescence phenomena. The utility of optical motion control (OMC) will be greatly enhanced with the advent of Shuttle/Spacelab payloads such as the Atmospheric Cloud Physics Laboratory (ACPL) in which the ambient opposing accelerations will be reduced to at least 1/1000 of that encountered on earth. This future ACPL capability together with current programs for developing shuttle compatible lasers in the 100-200 mW range will make it feasible to consider cloud physics experiments OMC on the earliest flights of the ACPL. GRA

N77-26742# Naval Research Lab., Washington, D. C.

A COMPARISON OF MEASURED 3.8 MICRON SCATTERING FROM NATURALLY OCCURING AEROSOLS WITH THAT PREDICTED BY MEASURED PARTICLE SIZE STATISTICS Interim Report, Jul. - Oct. 1975

P. M. Livingston Feb. 1977 34 p refs
(AD-A038032; NRL-MR-3450) Avail: NTIS HC A03/MF A01 CSCL 20/6

Recent field measurements of scattered 3.8 micron laser radiation from naturally occurring aerosols were made during a four-week period in coastal Southern California. Simultaneously, aerosol distribution measurements were made which, in conjunction with Mie scattering theory, gave estimates of the volume scattering coefficient at the various angles. A comparison shows that: (1) Calculated volume scattering coefficients generally decrease more rapidly in angle than measurements indicate; and (2) On the average, the calculation gives factor of 2 larger volume backscattering coefficients than measured, but underpredicts forward scattering by 33%. A second--unrelated--observation of interest: Volume scattering coefficients in the visible showed 65% correlation with 3.8 micron backscatter (177 deg) coefficients. Author (GRA)

N77-26743# Aerospace Corp., El Segundo, Calif. Space Science Lab.

BOUNCE-AVERAGED SYNCHROTRON LOSS IN A DIPOLE FIELD Interim Report

Michael Schulz 18 Feb. 1977 24 p refs
(Contract F04701-76-C-0077)
(AD-A037072; TR-0077(2260-20)-6; SAMSO-TR-77-52) Avail: NTIS HC A02/MF A01 CSCL 20/7

Accurate approximate expressions are derived (in closed form) for the bounce-averaged loss rates, (gamma dot) and (y dot) due to synchrotron radiation in a dipole field, where gamma - 1 is a particle's kinetic energy (in units of rest energy) and y is the sine of its equatorial pitch angle. The expressions for (gamma dot) and (y dot) factor so that (gamma dot) is equal to (gamma squared - 1) times a ratio of polynomials in y to the 1/4 power while (y dot) is equal to (1/gamma) times a different ratio of polynomials in y to the 1/4 power. The expressions apply to all values of gamma and y for which the adiabatic theory of charged-particle motion is a good approximation. Author (GRA)

N77-26744# Missouri Univ., Rolla. Dept. of Geology.

SEISMIC DETECTION OF SUBTERRANEAN CAVITIES Final Report, Sep. 1973 - Aug. 1976

Richard D. Rechtien, David M. Stewart, and Thom Cavanaugh 30 Nov. 1976 91 p refs
(AD-A035711; ARO-10878.2-EN) Avail: NTIS HC A05/MF A01 CSCL 17/10

Seismic signatures of void and mud-filled subterranean cavities are presented. The results imply that cavity interference with deep penetrating surface waves is the cause for the manifestation of diagnostic seismic events indicative of voids. Author (GRA)

N77-26745# Wellesley Instruments Corp., Waltham, Mass.

A DUAL ELECTRO-OPTICAL LIGHT IMAGE RECEIVER AND RECORDER Final Report, May 1976 - 31 Jan. 1977

Edward P. Morse Jan. 1977 30 p
(Contract F19628-76-C-0206; AF Proj. 7600)
(AD-A037955; AFGL-TR-76-0002) Avail: NTIS HC A03/MF A01 CSCL 20/5

A novel optical experiment is underway at the Air Force Geophysics Laboratories to measure rotation and translation of the earth's crust. The purpose of the experiment is to improve azimuth monitoring. The primary reference is a laser beam. The beam is optically split and aimed at two optical reflectors mounted on a common base in the earth's crust and normal to the horizontal. The reflected beam from reflector, a plane mirror, is a measure of vertical and horizontal rotation. The reflected beam from the second reflector, a corner cube, is a measure of vertical and horizontal translation. The Dual Electro-Optical Biaxial Sensor described in this report is designed to sense the movement of the laser beams and record the results on an Incremental Magnetic Recorder. The specification to measure position of each of the two reflected beams over a dynamic range of 12 mm with a resolution of 0.01 mm even with a large incident spot size, 20 mm, is met by employing a large biaxial Schottky barrier photodiode. The excellent repeatability of this electro-optical position detector permits calibration of non-linearity with post experiment computation to reduce error in measurement to 0.01 mm. GRA

N77-26746# Teledyne Geotechnical, Alexandria, Va. Seismic Data Analysis Center.

EVALUATION OF THE KOREAN SHORT-PERIOD ARRAY

Maurice Blaik and Zoltan Der 20 Apr. 1976 41 p refs
(Contract F08606-76-C-0004; ARPA Order 1620)
(AD-A035587; SDAC-TR-76-5) Avail: NTIS HC A03/MF A01 CSCL 08/11

The Korean Seismic Research Station (KSRS) short-period array was evaluated using data which cover eight-hour time periods daily between May and June 1973. Most of the data are of poor quality due to instrumental problems. The average noise reduction obtained by beaming was about 2 db better than (square root of n) due to the almost continuous presence of propagating coherent noise at the station. The 50% detection body wave magnitude threshold was found to be 4.35 + or - .45 (95% confidence interval) at the epicentral distance of 60 deg. The 90% detection threshold was found to be 5.42 + or - .45 magnitude units. Author (GRA)

N77-26747# Environmental Research and Technology, Inc., Concord, Mass.

AN ALGORITHM TO RETRIEVE WATER VAPOR INFORMATION FROM SATELLITE MEASUREMENTS Final Report

Robert K. Crane 22 Nov. 1976 52 p refs
(Contract N00228-75-C-2378)
(AD-A037405; NEPRF-TR-7-76(ERT)) Avail: NTIS HC A04/MF A01 CSCL 17/5

Radiance values for the eight water vapor channels on the DMSP/SSH infrared sounder were simulated for cloud free conditions. The simulated values were inverted using a statistical multiple regression procedure to estimate total precipitable water. Inversions were also obtained using both the infrared water vapor channel data and temperature profile data. For the sounder channels incorporated into the DMSP/SSH sensor package, profile measurements are not possible below the height of the tropopause using the infrared channel data alone. Successful inversions with more than an 80 percent reduction of variance from climatological values were accomplished using both

temperature profile data (perhaps obtained from the CO2 channel data) and one or more infrared water vapor channel observations. Author (GRA)

N77-26748# Rome Air Development Center, Griffiss AFB, N.Y.
VLF/LF REFLECTIVITY OF THE POLAR IONOSPHERE, 21 SEPTEMBER 1975 - 3 JANUARY 1976
John E. Rasmussen, Ralph J. McLain, John P. Turtle, and Wayne I. Klemetti Dec. 1976 40 p refs
(AD-A037794; RADC-TR-76-378) Avail: NTIS HC A03/MF A01 CSCL 17/2

This report provides a summary of high latitude ionospheric reflectivity as observed by the USAF high resolution VLF/LF ionosounder operating in northern Greenland. Ionospheric reflectivity parameters, including reflection coefficients and heights, are presented as a function of time of day. VLF long path propagation measurements, along with magnetometer and riometer data, are presented as supplemental information. Author (GRA)

N77-26749# Ohio State Univ., Columbus. Dept. of Geodetic Science.
LEAST-SQUARES COLLOCATION AS A GRAVITATIONAL INVERSE PROBLEM Interim Report
Helmut Moritz Nov. 1976 34 p refs
(Contract F19628-76-C-0010)
(AD-A037008; DGS-249; AFGL-TR-76-0278; SR-6) Avail: NTIS HC A03/MF A01 CSCL 08/5

The report compares least-squares collocation methods for determining the earth's gravitational field with geophysical inversion techniques. Both are underdetermined problems with strong structural similarities. Collocation is also considered from the point of view of representing the external gravitational field by means of analytic functions. Finally, the conceptual basis of least-squares collocation is briefly discussed. Author (GRA)

N77-26750# Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
CLASSIFICATION OF COASTAL ENVIRONMENTS
Bruce Hayden and Robert Dolan Jan. 1977 101 p refs
(Contract N00014-69-A-0060-0006; N00014-75-C-0480; NR Proj. 389-158; NR Proj. 389-170)
(AD-A036770; TR-13; TR-14; TR-15; TR-16; TR-17; TR-18) Avail: NTIS HC A06/MF A01 CSCL 08/6

Contents: Crescentic Coastal Landforms; Classification of Coastal Landforms of the Americas; Recent Secular Variations in Mid-Atlantic Winter Extratropical Storm Climate; Storm Wave Climates at Cape Hatteras, North Carolina; Recent Secular Variations; Multivariate and Spectral Analyses of Some Seasonal Aspects of Wave Climates; and January-Thaw Singularity and Wave Climate Along the Eastern Coast of the U.S.A. GRA

N77-26751# Hawaii Inst. of Geophysics, Honolulu.
COMPUTER PROGRAMS FOR SEISMOLOGY: SPECIAL APPLICATIONS TO THE HIGH-GAIN LONG-PERIOD SEISMIC NETWORK Interim Report
Duncan M. Chesley and Edward Berg Mar. 1976 92 p refs
(Grant AF-AFOSR-2612-74; ARPA Order 1827)
(AD-A037963; HIG-76-3; AFOSR-77-0257TR) Avail: NTIS HC A05/MF A01 CSCL 08/11

This report describes several IBM 270/158 computer programs that have been applied to long-period seismic data on digital tapes. Included are reading routines for tapes generated by the high-gain long-period (HGLP) stations, rotation of the horizontal components, low-, band-, and high-pass digital filters, correlation (or matched filtering), summation of correlations, beam focusing, and ground motion retrieval. Results of applications, described elsewhere or in preparation, include extraction and amplitude determination of Rayleigh waves with signal-to-noise ratios near 1 to 10 precision amplitude and phase calibration of entire seismic systems from transducer to final record, beam forming of matched filtered outputs from the randomly spaced HGLP station array, and separation of colocated multiple events with time spacing as short as 150 sec or separation of events widely spaced geographically but nearly simultaneously at a given station. Author (GRA)

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N77-26752 Deutscher Wetterdienst, Offenbach am Main (West Germany).
REPORTS FROM THE GERMAN METEOROLOGICAL SERVICE. VOLUME 18, NO. 141: THE CLIMATE OF HAMBURG. ANALYSIS FOR PURPOSES OF APPLIED CLIMATOLOGY WITH CATALOG OF DATA [BERICHTE DES DEUTSCHEN WETTERDIENSTES. BAND 18, NR. 141: DAS KLIMA VON HAMBURG. ANALYSE FUER ZWECKE DER ANGEWANDTEN KLIMATOLOGIE MIT DATENKATALOG]
Albert Cappel and Margret Kalb 1976 248 p refs In GERMAN; ENGLISH summary
(ISBN-3-88148-149-4) Avail: Issuing Activity

The climatological analysis presented describes in detail the most relevant climatic elements and contains more than 200 tables and figures based on the period 1931 to 1970. The tables provide monthly values of the total period as well as climatological normals for the period 1931 to 1960 and for the period 1951 to 1970, and frequency and sum values of individual climatic elements. Frequency distributions of combined elements offer a general survey of the statistical connections existing between two combined elements. The climatological analysis is based on climatic observations carried out at 7 a.m., 2 p.m., and 9 p.m. Mean Local Time, as well as on hourly synoptic observations and evaluations of records. Author (ESA)

N77-26753*# Sperry Support Services, Huntsville, Ala. Engineering Operations.
ATMOSPHERIC CLOUD PHYSICS THERMAL SYSTEMS ANALYSIS Final Report
15 Jun. 1977 140 p refs
(Contract NAS8-32231)
(NASA-CR-150312) Avail: NTIS HC A07/MF A01 CSCL 04B

Engineering analyses performed on the Atmospheric Cloud Physics (ACPL) Science Simulator expansion chamber and associated thermal control/conditioning system are reported. Analyses were made to develop a verified thermal model and to perform parametric thermal investigations to evaluate systems performance characteristics. Thermal network representations of solid components and the complete fluid conditioning system were solved simultaneously using the Systems Improved Numerical Differencing Analyzer (SINDA) computer program. Author

N77-26754# World Meteorological Organization, Geneva (Switzerland).
SCIENTIFIC LECTURES ON METEOROLOGY
1976 61 p refs Partly in FRENCH and partly in ENGLISH Proc. of the 7th World Meteorol. Congr., Geneva, May 1975
(WMO-435; ISBN-92-63-10435-2) Avail: NTIS HC A04/MF A01; WMO, Geneva; Sw. Fr. 16

The six lectures were divided into two groups of three and dealt with the following subjects: meteorology and hydrology in aid of food production, and implications of outer space technology on development in meteorology and meteorological services. For individual titles, see N77-26755 through N77-26759.

N77-26755# World Meteorological Organization, Geneva (Switzerland).
METEOROLOGY AND HYDROLOGY IN AID OF FOOD PRODUCTION
P. M. Austin Bourke *In its* Sci. Lectures on Meteorol. 1976 p 1-7 (For primary document see N77-26754 17-47)
Copyright. Avail: NTIS HC A04/MF A01; WMO, Geneva; Sw. Fr. 16

Some of the ways in which weather impinges on both the strategy and tactics of crop production are discussed. Problems in briefing the farmers together with reasons and remedies are noted and the implications of climatic fluctuations on food production are considered. ESA

N77-26756# World Meteorological Organization, Geneva (Switzerland).
USE OF CROP-WEATHER MODELS FOR ASSESSING POTENTIAL AGRICULTURAL PRODUCTION
W. Baier *In its* Sci. Lectures on Meteorol. 1976 p 8-25 refs (For primary document see N77-26754 17-47)
(Rept-891) Copyright. Avail: NTIS HC A04/MF A01; WMO, Geneva; Sw. Fr. 16

Following a general discourse on world grain production in relation to weather and climate, the three principal approaches for simulating, analyzing, and assessing crop responses to weather are described. For each of the types, examples are given with emphasis on empirical-statistical models. The practical use of crop-weather models is discussed. ESA

N77-26757# Chiatin County Weather Station, Shanghai (China).
METEOROLOGICAL SERVICE IN AID OF AGRICULTURAL PRODUCTION
Hsi Hsi-hsien *In* WMO Sci. Lectures on Meteorol. 1976 p 26-31 (For primary document see N77-26754 17-47)
Copyright. Avail: NTIS HC A04/MF A01; WMO, Geneva; Sw. Fr. 16

A general description of the role of meteorological services in the agricultural production of China is presented. The success of the service is also discussed. ESA

N77-26758# World Meteorological Organization, Geneva (Switzerland).
THE INFLUENCE OF SPACE TECHNIQUES ON THE DEVELOPMENT OF METEOROLOGY
I. P. Vetlov *In its* Sci. Lectures on Meteorol. 1976 p 35-46 (For primary document see N77-26754 17-47)
Copyright. Avail: NTIS HC A04/MF A01; WMO, Geneva; Sw. Fr. 16

Practical aspects of using meteorological data - in particular cloud studies by photography - obtained from meteorological satellites for operational work and development are discussed. ESA

N77-26759# World Meteorological Organization, Geneva (Switzerland).
TOWARDS A GLOBAL OPERATIONAL SYSTEM OF METEOROLOGICAL SATELLITES [VERS UN SYSTEME OPERATIONNEL GLOBAL DE SATELLITES METEOROLOGIQUES]
M. A. Villevieille *In its* Sci. Lectures on Meteorol. 1976 p 47-57 In FRENCH (For primary document see N77-26754 17-47)
Copyright. Avail: NTIS HC A04/MF A01; WMO; Geneva; Sw. Fr. 16

The concept of a meteorological satellite network is discussed together with its three attendant parts: information production (temporal and spatial frequency of observations), information movement (data acquisition/transmission), and information handling (data processing). ESA

N77-26760# Air Force Global Weather Central, Offutt AFB, Nebraska.
FORECAST GUIDES USED FOR THE CENTRALIZED TERMINAL FORECAST PROGRAM
Arthur T. Safford, III 1 Dec. 1976 566 p
(AD-A035651; AFGWC-TM-76-2) Avail: NTIS HC A24/MF A01 CSCL 04/2

The Forecast Guides contain an organized discussion of the synoptic weather types that occur in the U.S., a regional description of the synoptic effects, and an individual station breakdown of the local differences in these effects. This information is compiled as a training pamphlet for new forecasters at Air Force Global Weather Central. An extensive knowedge of the local effects at each station is necessary for successful forecasting from a centralized facility. This document is being published for use by other Air Weather Service units as a training aid. GRA

N77-26761# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 14805 LANCE MISSILE NUMBERS 3208/3207, ROUND NUMBERS 285 APT/286 APT, 29 JULY 1976 Meteorological Data Report
Jul. 1976 50 p
(AD-A037661; DR-923) Avail: NTIS HC A03/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 14805 Lance, Missile Numbers 3208/3207, Round Numbers 285 APT/286 APT, are presented in tabular form. Author (GRA)

N77-26762# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 15002 LITTLE JOHN MISSILE NUMBER 3139, ROUND NUMBER 723 RG (11) JANUARY 1977 Meteorological Data Report
Jan. 1976 20 p
(AD-A037660; DR-934) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 15002 Little John, Missile Number 3139, Round Number 723 RG, are presented in tabular form. Author (GRA)

N77-26763# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 12817C LANCE MISSILE NUMBER 2162 ECT, 15 OCTOBER 1976 Meteorological Data Report
Oct. 1976 32 p
(AD-A037941; DR-929) Avail: NTIS HC A03/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 12817C Lance, Missile Number 2162, Round Number 291 ECT, are presented in tabular form. Author (GRA)

N77-26764# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
THE 12817A LANCE MISSILE NUMBER 2241, ROUND 292 NUMBER ECL, 20 OCTOBER 1976
Oct. 1976 29 p
(AD-A037935; DR-930) Avail: NTIS HC A03/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 12817A Lance, Missile Number 2241, Round Number 292 ECL, are presented in tabular form. Author (GRA)

N77-26765# Army Electronics Command, Fort Monmouth, N. J.
AN APPROACH TO THE SHORT-RANGE PREDICTION OF EARLY MORNING RADIATION FOG Research and Development Technical Report
H. H. Monahan Jan. 1977 33 p refs
(AD-A037961; ECOM-5809) Avail: NTIS HC A03/MF A01 CSCL 04/2

A simplified approach is presented for the prediction of a 3-hour period between midnight and sunrise during which radiation fog formation will initially restrict prevailing surface visibilities to less than 1 statute mile. This approach considers the cooling below the dew point necessary to provide sufficient condensed moisture (0.5 gram of liquid water per kilogram of air) to form the restricting fog condition. A prediction verification of 71 percent was obtained from a total of 52 test cases in the Texas-Oklahoma area during the period 25-28 February 1973. Author (GRA)

N77-26766# Battelle Pacific Northwest Labs., Richland, Wash.
THEORETICAL STUDY OF THE EVOLUTION OF MIXED PHASE CUMULUS CLOUDS
B. C. Scott and P. V. Hobbs Jun. 1976 6 p refs Presented at the Intern. Conf. on Cloud Phys., Boulder, Colo., 26 Jul. 1976
(Contract E(45-1)-1830; Grant NSF ATM-74-14-726-A02) (BNWL-SA-5880; Conf-760742-1) Avail: NTIS HC A02/MF A01

Comparative studies of shallow, nonprecipitating, maritime and continental cumulus clouds have demonstrated the importance of the drop size distribution in determining the dominant mechanism for forming graupel. In the maritime cloud, where there are significant numbers of drops greater than 60 mu m graupel originates on frozen drops produced after collisions with ice crystals. At -10 C freezing nuclei produced only about 1 percent of the total graupel. In the continental cloud, the greater abundance of small drops smaller than 30 mu meter makes the crystal riming process more effective than the drop

freezing process, and graupel tends to originate on ice crystal embryos. ERA

N77-26767# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA. VOLUME 142, NO. 4: AEROLOGICAL DATA, BERLIN-TEMPELHOF, 1974 Quarterly Report, Oct. - Dec. 1974 [METEOROLOGISCHE ABHANDLUNGEN, BAND 142, HEFT 4: AEROLOGISCHE DATEN, BERLIN-TEMPELHOF, OKTOBER - DEZEMBER 1974]
Verlag von Dietrich Reimer 1975 250 p refs In GERMAN; ENGLISH summary Sponsored in part by Deut. Forschungsgemeinschaft
(QR-4) Avail: NTIS HC A11/MF A01

The detailed results of the radiosonde ascents performed by the institute's aerological station are presented in tabular and graphical form. Extreme and mean values of the temperature, pressure, geopotential, wind data, refractivity, pseudopotential temperature, and velocity of sound were extracted for all standard pressure surfaces, several height levels, the tropopause, and the freezing level. Author (ESA)

N77-26768# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA, SERIES A MONOGRAPHS. VOLUME 1, NO. 2: ACCURACY OF LOCATING DISTANT THUNDERSTORM CENTERS WITH HEINRICH HERTZ INSTITUTE'S VLF ATMOSPHERICS ANALYZER Ph.D. Thesis [METEOROLOGISCHE ABHANDLUNGEN, SERIE A MONOGRAPHIEN. BAND 1, HEFT 2. UNTERSUCHUNGEN ZUR GENAUIGKEIT DER ERFASSUNG WEITENTFERNTER GEWITTERHERDE MIT DEM VLF-ATMOSPHERICS-ANALYSATOR DES HEINRICH-HERTZ-INSTITUTS]
Juergen Pelz Verlag von Dietrich Reimer 1975 57 p refs In GERMAN; ENGLISH summary Sponsored by Deut. Forschungsgemeinschaft
Avail: NTIS HC A04/MF A01

The accuracy of locating atmospherics sources was investigated using meteorological methods. The investigations were concentrated on the Caribbean Sea and Central America. As regards this area, Berlin is situated in the best direction of propagation. It was established that the group delay time difference related to the distance transmitter-receiver shows a strong annual and daily variation. If that variation is known, the source of the atmospherics (thunderstorms) can be located with a mean error of about 5%. Author (ESA)

N77-26769# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA, SERIES B BASIC MATERIAL VOLUME 3, NO. 4: DAILY ALTITUDE CHARTS OF THE 50 mb PLANE AND MONTHLY AVERAGE CHARTS FOR THE YEAR 1975, PART 4 Quarterly Report, 1 Oct. - 31 Dec. 1975 [METEOROLOGISCHE ABHANDLUNGEN, SERIE B GRUNDLAGENMATERIAL BAND 3, HEFT 4: TAEGLICHE HOEHENKARTEN DER 50-mb-FLAECHE SOWIE MONATLICHE MITTELKARTEN FUER DAS JAHR 1975, TEIL 4, 4. VIERTELJAHR]
Verlag von Dietrich Reimer 1975 131 p In GERMAN; ENGLISH summary Sponsored by Deut. Forschungsgemeinschaft Original contains color illustrations
(QR-4-Pt-4) Avail: NTIS HC A07/MF A01

A series of stratospheric weather maps published since 1957 in the Transactions of the Meteorological Institute of the Free University are presented. These contain height and temperature analyses of constant pressure levels for three months for the whole of the Northern Hemisphere, based on rawinsonde and, in the upper stratosphere, also on rocketsonde data and performed with the aid of a hydrostatic build-up method. The corresponding monthly mean maps, their variations and deviations, are included as well as the mean grid point data, calculated from daily values. The stratospheric circulation of polar, middle, and tropical latitudes is described for the period under consideration. Author (ESA)

N77-26770# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA, SERIES B BASIC MATERIAL VOLUME 4, NO. 3: DAILY ALTITUDE CHARTS OF THE 30 mb PLANE AND MONTHLY AVERAGE CHARTS FOR THE YEAR 1975, PART 3 Quarterly Report, 1 Jul. - 30 Sep. 1975 [METEOROLOGISCHE ABHANDLUNGEN, SERIE B GRUNDLAGENMATERIAL BAND 4, HEFT 3: TAEGLICHE HOEHENKARTEN DER 30-mb-FLAECHE SOWIE MONATLICHE MITTELKARTEN FUER DAS JAHR 1975. TEIL 3, 3. VIERTELJAHR]
Verlag von Dietrich Reimer 1975 131 p In GERMAN; ENGLISH summary Sponsored by Deut. Forschungsgemeinschaft Original contains color illustrations
(QR-3-Pt-3) Avail: NTIS HC A07/MF A01
For abstract, see N77-26769.

N77-26771# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA, SERIES B BASIC MATERIAL VOLUME 4, NO. 4: DAILY ALTITUDE CHARTS OF THE 30 mb PLANE AND MONTHLY AVERAGE CHARTS FOR THE YEAR 1975, PART 4 Quarterly Report, 1 Oct. - 31 Dec. 1975 [METEOROLOGISCHE ABHANDLUNGEN, SERIE B GRUNDLAGENMATERIAL BAND 4, HEFT 4: TAEGLICHE HOEHENKARTEN DER 30-mb-FLAECHE SOWIE MONATLICHE MITTELKARTEN FUER DAS JAHR 1975. TEIL 4, 4. VIERTELJAHR]
Verlag von Dietrich Reimer 1975 131 p In GERMAN; ENGLISH summary Sponsored by Deut. Forschungsgemeinschaft Original contains color illustrations
(QR-4-Pt-4) Avail: NTIS HC A07/MF A01
For abstract, see N77-26769.

N77-26772# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA, SERIES B BASIC MATERIAL VOLUME 5, NO. 3: EUROPEAN CLIMATOLOGY 1975. WEATHER SATELLITE DATA RECEIVED IN THE BERLIN AREA, PART 3 Quarterly Report, 1 Jul. - 30 Sep. 1975 [METEOROLOGISCHE ABHANDLUNGEN, SERIE B GRUNDLAGENMATERIAL BAND 5, HEFT 3: DAS EUROPAEISCHE WETTERBILD 1975. WETTERSATELLITEN-DATEN AUS DEM BERLINER EMPFANGSBEREICH. TEIL 3, 3. VIERTELJAHR, 1. JULI BIS 30. SEPTEMBER 1975]
Verlag von Dietrich Reimer 1975 201 p In GERMAN
(QR-3-Pt-3) Avail: NTIS HC A10/MF A01

Daily European weather pictures are presented for the third quarter of 1975. These are based mainly on the APT single takes from the ESSA 8 satellite and include NOAA 4 visible range data for two days. ESA

N77-26773# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA, SERIES B BASIC MATERIAL VOLUME 5, NO. 4: EUROPEAN CLIMATOLOGY 1975. WEATHER SATELLITE DATA RECEIVED IN THE BERLIN AREA, PART 4 Quarterly Report, 1 Oct. - 31 Dec. 1975 [METEOROLOGISCHE ABHANDLUNGEN, SERIE B GRUNDLAGENMATERIAL BAND 5, HEFT 4: DAS EUROPAEISCHE WETTERBILD 1975. WETTERSATELLITEN-DATEN AUS DEM BERLINER EMPFANGSBEREICH. TEIL 4, 4. VIERTELJAHR, 1. OKTOBER BIS 31. DEZEMBER 1975]
Verlag von Dietrich Reimer 16 Oct. 1975 209 p refs In GERMAN Presented at Forschungsseminar der WAG 7 Satellitenmeteorol., 15 Oct. 1975
(QR-4-Pt-4) Avail: NTIS HC A10/MF A01

Daily European weather pictures are presented for the last quarter of 1975. These are based partly on the APT single takes from the ESSA 8 satellite and partly on the scanning radiometer data from the NOAA 4 satellite. The aspect of digital filtering in processing the NOAA 4 images is described. ESA

N77-26774# World Meteorological Organization, Geneva (Switzerland).
WORLD WEATHER WATCH. CONSOLIDATED REPORT ON THE VOLUNTARY ASSISTANCE PROGRAMME INCLUDING PROJECTS APPROVED FOR CIRCULATION IN 1976
Jan. 1977 436 p
(WMO-465; ISBN-92-63-10465-4) Avail: NTIS HC A19/MF A01; WMO, Geneva

General remarks on the states of the overall Voluntary

Assistance Program (VAP) are followed by guidelines for use in the implementation of World Weather Watch projects through VAP. Equipment required to implement VAP projects approved for 1976 is listed as are members' contributions to VAP. The status of the implementation of VAP projects on 31 December 1976 is given together with full lists of individual VAP projects approved for circulation in 1976 and projects approved for circulation between 1968 and 1975 which have since been modified. ESA

N77-26775# Mitre Corp., Bedford, Mass.
EFFECTS OF WEATHER ON NATO/WARSAW PACT AIR/GROUND OPERATIONS
V. J. Stakutis Jan. 1977 91 p refs
(Contract F19628-76-C-0001)
(AD-A037313; MTR-3300; ESD-TR-76-292) Avail: NTIS HC A05/MF A01 CSCL 04/2

This paper was prepared in support of a Project 7900 long-term analysis to better understand and define the integrated air/ground threat in central Europe. The paper provides a descriptive summary of environmental conditions in central Europe whose probability for recurrence in calendar time can be predicted broadly from a long statistical history of occurrence. The effect of the conditions on military operations is assessed in terms of the opportunities it provides and/or the limitations it imposes. Author (GRA)

N77-26776# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
MESOSCALE DETERMINATION OF CLOUD-TOP HEIGHT: PROBLEMS AND SOLUTIONS
Richard D. H. Low and J. D. Horn Mar. 1977 42 p refs
(DA Proj. 1T1-61101-A-91A)
(AD-A037954; ECOM-5814) Avail: NTIS HC A03/MF A01 CSCL 04/2

This report presents an overview of the problems dealing with the mesoscale determination of cloud-top height from the infrared imagery of the geostationary operational environmental satellites, the GOES series. Such problems as the blackbody assumption of clouds, the field OV view of the satellite radio meter, instrument response, the presence of overlying thin cirrus clouds, gaseous absorption in the 10.5 micrometer to 12.6 micrometer infrared band, and the temperature-height relationships within and without the cloud as well as some solutions are discussed. These problems reduce to one of finding the true cloud temperature. It is argued that computer simulation of various cloudy situations by solving the radiative transfer equation for a plane parallel inhomogeneous cloud atmosphere may prove ultimately to be less costly and more effective. Author (GRA)

N77-26777# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 12815C LANCE MISSILE NUMBER 2473, ROUND NUMBER 289 RST (7 OCTOBER 1976) Meteorological Data Report
Oct. 1976 40 p
(AD-A037940; DR-927) Avail: NTIS HC A03/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 12815C Lance, Missile Number 2473, Round Number 289 RST, are presented in tabular form. Author (GRA)

N77-26778# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 12811A LANCE MISSILE NUMBER 2200, ROUND NUMBER 293 RCL (13 JANUARY 1977) Meteorological Data Report
Jan. 1977 30 p
(AD-A037939; DR-935) Avail: NTIS HC A03/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 12811A Lance, Missile Number 2200, Round Number 293 RCL, are presented in tabular form. Author (GRA)

N77-26779# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 15002A LITTLE JOHN MISSILE NUMBER 1936, ROUND NUMBER 722 RG (7 DECEMBER 1976) Meteorological Data Report
Dec. 1976 25 p
(AD-A037938; DR-933) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 15002A Little John, Missile Number 1936, Round Number 722 RG, are presented in tabular form. Author (GRA)

N77-26780# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 03702A HONEST JOHN MISSILE NUMBER 1547, ROUND NUMBER 655 AML (3 DECEMBER 1976) Meteorological Data Report
Dec. 1976 22 p
(AD-A037937; DR-932) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 03702A Honest John, Missile Number 1547, Round Number 655 AML, are presented in tabular form. Author (GRA)

N77-26781# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 03702A HONEST JOHN MISSILE NUMBER 1548, ROUND NUMBER 654 AML (15 NOVEMBER 1976) Meteorological Data Report
Nov. 1976 17 p
(AD-A037936; DR-931) Avail: NTIS HC A02/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 03702A Honest John, Missile Number 1548, Round Number 654 AML, are presented in tabular form. Author (GRA)

N77-26782# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
THE 12811A LANCE MISSILE NUMBER 2611, ROUND NUMBER 287 ACT (30 SEPTEMBER 1976) Meteorological Data Report
Sep. 1976 47 p
(DA Proj. 1T6-65702-D-127)
(AD-A037934; DR-925) Avail: NTIS HC A03/MF A01 CSCL 04/2

Meteorological data gathered for the launching of 12811A Lance, Missile Number 2611, Round Number 287 ACT, are presented in tabular form. Author (GRA)

N77-26783# Naval Postgraduate School, Monterey, Calif.
AN EXAMINATION OF TURBULENT DISSIPATION IN THE MARINE BOUNDARY LAYER M.S. Thesis
George William Karch Dec. 1976 73 p refs
(AD-A035706) Avail: NTIS HC A04/MF A01 CSCL 04/2

Shipboard measurements of temperature and velocity fluctuations were performed to determine optical propagation properties of the marine boundary layer. Empirical expressions describing the temperature structure parameter. C sub T2, in terms of the Richardson number, Ri, overland were used to evaluate data obtained for open ocean conditions. Profiles of the dissipation of turbulent kinetic energy, epsilon, with respect to height, Z, and with respect to a stability parameter, A/L, were examined for open ocean conditions. In general, there was little correlation between the measured C sub T2 and the stability parameter. However, the distribution of epsilon with height for both the stable and unstable cases showed little deviation from that expected for near neutral conditions. GRA

N77-26784# Battelle Columbus Labs., Ohio.
THE TRANSPORT OF OXIDANT BEYOND URBAN AREAS. COMPILATION OF DATA FOR THE NEW ENGLAND STUDY, 1975 Final Report
Chester W. Spicer, Darrell W. Joseph, and Gerald F. Ward Nov. 1976 398 p
(Contract EPA-68-02-2241)
(PB-264205/6; EPA-600/3-76-109) Avail: NTIS HC A17/MF A01 CSCL 04B

A study of oxidant transport was conducted in New England for wide area and vertical aerial sampling. The mobile laboratory was equipped to continuously monitor O3, NO, NO2, NOx, CH4, C2H2, C2H4, C2H6, non-methane hydrocarbon, fluorocarbon

11(F-11), CC14, CO, temperature, solar intensity, relative humidity, wind speed, wind direction, and barometric pressure. The airplane was outfitted to continuously monitor ozone, nitric oxide, and temperature and to collect air samples in Teflon bags. The bag samples were analyzed GRA

N77-26785# Bureau of Reclamation, Denver, Colo. Engineering and Research Center.

PROJECT SKYWATER: ATMOSPHERIC WATER RESOURCES PROGRAM Biennial Report, FY 1973 - 1974

Dec. 1976 544 p refs

(PB-263952/4; REC-ERC-76-21) Avail: NTIS HC A23/MF A01 CSCL 04B

Chapter 1 outlines the project, its goals and depth. The next three chapters consist of summaries of the reports submitted by contractors who participated in the winter-orographic and summer-convective experiments and pilot programs of Project Skywater during the biennium. The effects of weather modification on natural resources and processes and on socioeconomic and cultural patterns were the emphasis of numerous Skywater studies during fiscal years 1973 - 1974. Summaries of these investigations are given in chapter 5. Chapters 6 and 7 describe laboratory studies and in-house programs in support of Project Skywater. GRA

N77-26786# National Oceanic and Atmospheric Administration, Boulder, Colo. Atmospheric Physics and Chemistry Lab.

SIMULATION OF COLD CLOUD PRECIPITATION IN A THREE-DIMENSIONAL MESOSCALE MODEL

Charles F. Chappell and David R. Smith Oct. 1976 32 p refs

(PB-265265; NOAA-77030801) Avail: NTIS HC A03/MF A01 CSCL 04B

A cold cloud microphysical model is developed and merged with a 15-level primitive equation mesoscale dynamical model. The microphysical model partitions ice particles into three categories: unrimed, partially rimed, and graupel. Each is considered to have a Marshall-Palmer distribution, and is assigned its own set of physical characteristics. Criteria for converting from one ice particle category to another are based on a comparison of accretional to depositional growth rates. Six prognostic equations predict the concentration and mixing ratio for each ice particle category. Processes in the model include deposition, accretion, condensation, evaporation, sublimation, nucleation, and sedimentation. Microphysical processes are coupled back into the dynamical prediction equations so that the effect of ice processes on the air flow can be investigated. The mesoscale model is used to investigate numerically the development and distribution of snowfall over a mountain massif during a 4500-second integration. It appears to simulate realistically the nucleation and growth of ice particles and their transport and sedimentation to the mountain surface. Author

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N77-26787# Texas A&M Univ., College Station. Dept. of Oceanography.

PROCEEDINGS OF A WORKSHOP ON ENVIRONMENTAL OCEANOGRAPHY OF THE GULF OF MEXICO

1976 55 p Workshop held at College Station, Tex., 15-16 Mar. 1976

(Contract E(40-1)-5017)

(ORO-5017-1; Conf-760363) Avail: NTIS HC A04/MF A01

A workshop was convened to define the most critical energy-related environmental problems in the Gulf of Mexico and develop the framework for a program of research to solve these problems. A major and immediate concern is activity related to the oil and gas industry: production, transportation (including potential superport construction), processing, and use of petroleum-derived fuels. The problems which might be posed by the development of other potential sources of energy, such as coastal and offshore nuclear power plants, were also given consideration. ERA

N77-26788# Naval Intelligence Support Center, Washington, D. C. Translation Div.

GENERATION OF INTERNAL WAVES BY A MOVING REGION OF PRESSURES IN A SEA WITH A DISCONTINUITY LAYER

S. F. Dotsenko and L. V. Cherkeson 1 Feb. 1977 13 p refs Transl. into ENGLISH from Tr. Morsk. Gidrofizicheskiy Inst. (USSR), no. 3, 59, 1972 p 25-38

(AD-A036887; NISC-Trans-3897) Avail: NTIS HC A02/MF A01 CSCL 20/4

Steady internal waves in a sea, caused by displacement of a region of baric disturbances, are investigated. The continuous density stratification is such that the Vaisala-Brunt frequency is zero in the upper and lower layers and positive in the middle layer (discontinuity layer). Author (GRA)

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N77-26789# Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).

ACQUISITION AND ACTIVITY IN AGED RATS

O. L. Wolthuis, D. L. Knook (Inst. voor Exptl. Geront. TNO), and V. J. Nickolson Apr. 1976 14 p refs

(MBL-1976-4; TDCK-67752) Avail: NTIS HC A02/MF A01

Rats of ages 3, 12, 18, and 30 months (3M, 12M, 18M, and 30M) were trained by conditioned suppression of drinking behavior using punishment or reward. In addition, spontaneous motor behavior was measured. Acquisition rates of the 30M rats were lower than those of 12M and 3M rats, and 3M rats exhibited higher activity than both 30M and 12M rats. It is concluded that the acquisition deficits of 30M rats develop beyond the age of 18 months, independent of differences in activity, reactivity to foot shock, or motor skill. Author (ESA)

N77-26790# Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).

ISOLATION OF ANTIBODY FORMING CELLS BY USING CLUSTER FORMATION IN COMBINATION WITH VELOCITY SEDIMENTATION

F. H. Lubbe, G. Rossi, and O. B. Zaalberg May 1976 20 p refs

(MBL-1976-6; TDCK-67805) Avail: NTIS HC A02/MF A01

A method to isolate antibody forming cells with the help of cluster formation is described. This was achieved by incubating spleen cells from immunized mice with sheep erythrocytes at 37 C. During incubation a rabbit-anti-mouse immunoglobulin serum was present in order to facilitate the formation of clusters. Thereafter, the clusters were isolated by velocity sedimentation. In this way suspensions containing more than 80 % clusters were obtained. Some of the cells in the clusters still produced antibodies against sheep erythrocytes when cultured for two days in vitro. Author (ESA)

N77-26791# Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).

OXIME THERAPY AND OXIME BLOOD LEVELS IN RATS: DEPENDENCE ON THE DOSE OF THE ORGANOPHOSPHATE

Otto L. Wolthuis, Herma J. ClasonvanderWiel, and Rob P. L. S. Visser May 1976 12 p refs

(MBL-1976-7; TDCK-67804) Avail: NTIS HC A02/MF A01

Atropinized anesthetized rats were intravenously (i.v.) injected with 4, 6, or 8 x LD50 of the organophosphorous cholinesterase inhibitor soman. Immediately thereafter all animals received an i.v. injection of 100 mg/kg of the oxime HS-6, followed in half of the animals by an infusion of HS-6 of 100 mg/kg/h. The single dose of the oxime delayed the onset of respiratory failure by one hour or more depending on the dose of soman. Infusion of HS-6 further postponed respiratory failure except in the group given 8 x LD50 soman. It was found that at the same infusion rate of HS-6 the blood concentrations of this oxime rose considerably as the dose of soman was increased. It is suggested that the respiratory failure after low, lethal doses of soman is caused by reinhibition of cholinesterase by circulating soman in

animals which receive a single injection of HS-6. After higher doses of soman respiratory failure is caused by toxic side effects of the oxime. Author (ESA)

N77-26792# Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).
IN VITRO EVALUATION OF SOME LATENT RADIOPROTECTIVE COMPOUNDS
O. Vos, G. A. Grant (Defence Chem., Biol. and Radiation Establ., Ottawa), and L. Budke Aug. 1976 31 p refs
(MBL-1976-11; TDCK-68126) Avail: NTIS HC A03/MF A01

Protection against X-irradiation by a number of cysteamine derivatives was studied in tissue culture and the results compared with data obtained in mice. Compounds with a covered SH group like WR 638, cysteamine phosphate, WR 2721, and AE 48527, showed practically no protection when dissolved in tissue culture medium but developed a protective activity when dissolved in rat blood. Thiol measurements demonstrated that in rat blood the compounds were partly hydrolyzed to thiols. C511 was also hydrolyzed in culture medium and was slightly less effective than cysteamine in culture medium. Cysteamine phosphate was hydrolyzed more easily than cysteamine sulphate and concordantly the protective activity in rat blood was better. WR 2721 was also partly hydrolyzed in rat blood. The in vitro protection of this compound was disappointing when compared with results in vivo. Its SH form (WR 1065) also showed less protection than expected from in vivo experiments. Author (ESA)

N77-26793# Chemical Lab. RVO-TNO, Rijswikj (Netherlands).
SELECTIVE ENRICHMENT AND ISOLATION OF MICROORGANISMS ON ETHYL S-DIISOPROPYL AMINOETHYL METHYLPHOSPHONTHIOATE (VX)
E. Holwerda Nov. 1975 40 p refs In DUTCH; ENGLISH summary
(CL-1975-27; TDCK-67497) Avail: NTIS HC A03/MF A01

Some investigations were made to obtain a selective enrichment in soil of micro-organisms utilizing O-ethyl S-(2-diisopropylaminoethyl) methyl thiophosphonate (VX) on addition of 1 mg VX per g soil. Repeated contamination was needed as a result of the low stability of VX in soil. Shifts in microbial populations occurred. Aqueous solutions of VX (1 mg/ml) were inoculated with an extract of the soil being treated in this manner. Degradation of VX was followed enzymatically, the viable counts were estimated with the plate-count technique. As a result some colonies on count plates were obtained of species which are at least able to survive in the presence of VX. Author (ESA)

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N77-26794*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
STARPAHC OPERATIONAL REPORT Interim Report, May 1975 - Oct. 1976
15 Jan. 1977 149 p
(Contract NAS9-13170)
(NASA-CR-151432; LMSC-D508255; IR-3) Avail: NTIS HC A07/MF A01 CSCL 06E

The results of the first one and one-half years of operation of the STARPAHC system are presented. An operational cost summary analysis is included as well as the following: (1) Medical evaluation results, (2) system usage, and (3) hardware evaluation results. B.B.

N77-26795*# Indiana Univ., Bloomington. Section on Pharmacology.
STUDIES IN NEUROENDOCRINE PHARMACOLOGY Final Report
Roger P. Maickel 30 Apr. 1976 307 p refs
(Grant NGL-15-003-117)
(NASA-CR-153278) Avail: NTIS HC A14/MF A01 CSCL 06E

The expertise and facilities available within the Medical Sciences Program section on Pharmacology were used along with informational input from various NASA sources to study areas relevant to the manned space effort. Topics discussed include effects of drugs on deprivation-induced fluid consumption, brain biogenic amines, biochemical responses to stressful stimuli, biochemical and behavioral pharmacology of amphetamines, biochemical and pharmacological studies of analogues to biologically active indole compounds, chemical pharmacology: drug metabolism and disposition, toxicology, and chemical methodology. Appendices include a bibliography, and papers submitted for publication or already published. Author

N77-26796*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
A CERVIX-TO-RECTUM MEASURING DEVICE IN A RADIATION APPLICATOR FOR USE IN THE TREATMENT OF CERVICAL CANCER Patent Application
David R. Fischell (Howard Univ.) and Jeffrey Mazique, inventors (to NASA) (Howard Univ.) Filed 12 May 1977 12 p
(Grant NGT-09-011-051)
(NASA-Case-GSC-12081-2; US-Patent-Appl-SN-796258) Avail: NTIS HC A02/MF A01 CSCL 06B

A cervix-to-rectum measuring device to be used in the treatment of cervical cancer is described which includes a handle and a probe pivotably connected to the handle for insertion in the rectum. The measuring device further includes means for coupling the handle to an intrauterine radiation applicator when the latter is positioned in the uterine cervix and the probe is inserted in the rectum to pivot the handle about the probe. A gear is provided which is adapted to pivot with the probe. A pinion pivotably connected to the handle meshes with the gear. A pointer fixed to the pinion is displaced in response to the pivoting of the handle about the probe, and this displacement can be read from a scale on the handle, providing an indication of the cervix-to-rectum distance. NASA

N77-26797*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
DETERMINATION OF ANTIMICROBIAL SUSCEPTIBILITIES OF INFECTED URINES WITHOUT ISOLATION Patent Application
Grace L. Picciolo, Emmett W. Chapelle, Jody W. Deming (New England Medical Center, Boston), Christian G. Schrock (New England Medical Center, Boston), Hiller Vellend (New England Medical Center, Boston), Michael J. Barza (New England Medical Center, Boston), and Louis Weinstein, inventors (to NASA) (New England Medical Center, Boston) Filed 23 Apr. 1976 24 p
(NASA-Case-GSC-12046-1; US-Patent-Appl-SN-680015) Avail: NTIS HC A02/MF A01 CSCL 06B

Method is described for the quick determination of the susceptibilities of various unidentified bacteria contained in aqueous physiological fluid sample, particularly urine, to one or more antibiotics. A bacterial adenosine triphosphate (ATP) assay is carried out after the elimination of nonbacterial ATP to determine whether an infection exists. If an infection does exist, a portion of the sample is further processed, including subjecting parts of the portion to one or more antibiotics. Growth of the bacteria in the parts are determined, again by an ATP assay, to determine whether the unidentified bacteria in the sample are susceptible to the antibiotic or antibiotics under test. NASA

N77-26798# Los Alamos Scientific Lab., N. Mex. Mammalian Biology Group.
CESIUM-137 WHOLE-BODY CONTENT IN A NORMAL NEW MEXICO POPULATION
R. G. Thomas, C. R. Richmond, J. E. Furchner, and E. C. Anderson 1976 14 p refs Presented at 10th Midyear Symp. for Health Phys. Soc., New York, 11 Oct. 1976
(Contract W-7405-eng-36)
(LA-UR-76-2097; Conf-761031-5) Avail: NTIS HC A02/MF A01

Nanocuries of cesium-137 and potassium-40 were measured periodically in a fairly consistent population of normal New Mexicans. A large liquid scintillation detector was used for whole body gamma ray counting. Data are expressed in terms of picocuries of cesium-137 per gram of body potassium. Following the peaks of high level atmospheric testing (early to mid-1960's) the levels rose, approaching 120 pCi/gK. For the five year period beginning in 1964 there was a steady decline. During the years

of 1969 through 1973 the whole body levels were esentially constant at approximately 20 pCi/gK. A gradual decline occurred over the next two years, reaching the current level of about 10 pCi/gK. A group of 100 individuals was counted during the summer of 1976 and these data are presented, showing that they follow a normal distribution. ERA

N77-26799# Los Alamos Scientific Lab., N. Mex.
BIOLOGICAL EFFECTS OF NEGATIVE PIONS
M. R. Raju, H. I. Amols, E. Bain, S. G. Carpenter, J. F. Dicello, J. F. Frank, R. A. Tobey, and R. A. Walters 1976 33 p refs Presented at Intern. Conf. on Particles and Radiation Therapy, Berkeley, Calif., 15-17 Sep. 1976 Sponsored in part by National Cancer Inst.
(Contract W-7405-eng-36)
(LA-UR-76-2529; Conf-760946-5) Avail: NTIS HC A03/MF A01

Biological effects at the beam entrance were found to be nearly the same as conventional radiations, although some reports have indicated a higher RBE. LET distribution at the peak of a nearly monoenergetic pion beam is not much different from fast neutrons; therefore, one would expect similar biological responses, and the results are consistent with this hypothesis. The RBE peak/RBE plateau ratio is decreased with increasing width of the peak. The OER (approximately 1.6) at the peak for a nearly monoenergetic pion beam is also similar to fast neutrons and is expected to increase with increasing width of the peak. ERA

N77-26800# EEG Research Inst., Oslo (Norway).
INVESTIGATION ON THE SATURATION AND CLEARANCE OF HYDROGEN GAS IN THE BRAIN AND EXTREMITIES OF MAN, AND INVESTIGATIONS ON BIOMEDICAL MONITORING OF DIVERS IN WET-SUITS Final Report, 15 Mar. 1972 - 14 Nov. 1976
Carl Wilhelm Sem-Jackson 14 Nov. 1976 20 p refs
(Contract N00014-72-C-0345)
(AD-A037498) Avail: NTIS HC A02/MF A01 CSCL 06/19

Hydrogen gas clearance and saturation in the brain have been monitored in 22 subjects - twice in 4 of them with 6 months intervals. The half time for hydrogen gas clearance/saturation in the human brain may fluctuate between 1/2 minute and 30 minutes in grey matter and between 6-12 and 14 minutes in white matter. There must be a focal mechanism regulating the blood flow to various areas of the brain. The Vesla on Person Biomedical Monitoring Equipment has been refined. The unit is fitted in a water tight clam shell, to be carried on the diver's back. GRA

N77-26801# Pennsylvania State Univ., University Park. Center for Air Environment Studies.
INFLUENCE OF ALTERED GASEOUS ENVIRONMENTS ON LUNG METABOLISM Final Progress Report, 1 Jul. 1974 - 31 Aug. 1976
Rodney A. Rhoades Sep. 1976 56 p refs
(Grant AF-AFOSR-2767-75)
(AD-A037977; CAES-Pub-445-76; AFOSR-77-0315TR) Avail: NTIS HC A04/MF A01 CSCL 06/20

Isolated lungs were perfused 1.5 hours with a medium of washed bovine red cells resuspended to a 15 percent hematocrit with Krebs-Henseleit bicarbonate buffer containing 5 gram percent albumin. Substrate concentrations were 6 millimolar glucose and 1 millimolar palmitate. Data from altered carbon dioxide tension experiments indicate that prior exposure to high carbon dioxide tension markedly alters the lung's ability to maintain synthesis of cellular constituents from glucose. In a second series of experiments, acute effects of hyperoxia on lung metabolism were examined. Lactate production increased and pyruvate decreased. Data from a series of test of hypoxia on cyclic nucleotides indicate that hypoxia has a selective action on lung cAMP and nutritional stress, potentiates a hypoxic-hypercapnia exposure, and drastically alters lung weight, glycolysis and lipid synthesis in the lung. Author (GRA)

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N77-26802# Kentucky Univ., Lexington.
THE DEVELOPMENT, MAINTENANCE, AND MATHEMATICAL DESCRIPTION OF TRACKING BEHAVIOR IN MAN AND THE RHESUS MONKEY Annual Report, 1 Oct. 1975 - 30 Sep. 1976
D. F. McCoy and P. K. Bhagat 19 Nov. 1977 40 p
(Grant AF-AFOSR-2751-75)
(AD-A038006; AFOSR-77-0377TR) Avail: NTIS HC A03/MF A01 CSCL 05/10

The overall objective of this research was to explore several possible training methods to produce efficient compensatory tracking in the rhesus monkey. Various approaches were used. Several animals were successfully trained, and a five-parameter model was developed to describe this behavior mathematically. A major finding was that no detrimental effects were evidenced following a shift from pursuit to compensatory tracking. This finding agrees with the findings of others in human tracking situations and illustrates another similarity between human and subhuman response to discrete tracking tasks. The study showed that no special retraining procedures are required to train subhuman primates on either pursuit or compensatory tracking and this feature, that of a universal training method, was a primary goal of this research. Another major finding was that, based on the assumption that low doses of tranquilizing drugs may improve tracking efficiency of shock conditioned animals, it appears that the effect of tranquilizers was dependent as much on the individual animal as it was on dose level. GRA

N77-26803# Grumman Aerospace Corp., Bethpage, N.Y.
A-6E SYSTEMS APPROACH TO TRAINING, PHASE 1 Final Report, Apr. 1975 - May 1976
Samuel C. Campbell, Joseph Feddern, George Graham, and Martin Morganlander Feb. 1977 94 p refs
(Contract N61339-75-C-0099)
(AD-A037468; NAVTRAEQUIPC-75-C-0099-1) Avail: NTIS HC A05/MF A01 CSCL 05/9

This report describes one of four Phase I programs, namely the A-6E TRAM Instructional Systems Development (ISD) Program, established to evaluate the application of a Systems Approach to Training (SAT) in Naval aircraft programs. The research and development goals of this program were to: (a) evaluate a variety of ISD methods and procedures as applied to the aircrew training, (b) achieve a better understanding of the constraints and operating conditions that affect aircrew training, and (c) acquire cost, scheduling, and manpower data for future ISD planning. The operational goal was to design an A-6E TRAM aircrew training program. The approach used to achieve the above goals conformed basically to the ISD methodology. The report discussed the Task Analysis, the development of Specific Behavioral Objectives (SBOs), the selection of instructional media, and the formulation of Lesson Specifications. The role of the Subject Matter Expert (SME) is reviewed, as is the requirement for quantitative standards of performance. The operational aspects of the A-6E Training Program are addressed: program costs and manpower data are included. Specific media requirements and recommendations are presented. Generic descriptions of appropriate training devices are provided. The report includes a number of conclusions and recommendations and a 30-item reference section. Author (GRA)

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N77-26804*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

REMOTE MANIPULATOR SYSTEM STEERING CAPABILITY FOR SVDS

D. T. Martin May 1977 49 p refs

(Contract NAS9-15200)

(NASA-CR-151438; LEC-10595; JSC-12628) Avail: NTIS HC A03/MF A01 CSCL 05H

Details of the remote manipulator system steering capability to be implemented into the space vehicle dynamics simulator are reported. The resolve rate law is included as part of the overall steering capability. The steering model includes three automatic modes, four manual augmented modes, and a single joint rate mode. Author

N77-26805# Royal Naval Personnel Research Committee, London (England).

A STUDY USING INFRA RED THERMOGRAPHY OF CLOTHING ASSEMBLIES FOR USE BY PERSONNEL WORKING BENEATH OPERATING HELICOPTERS

R. Clark, B. J. Mullan, and M. R. Goff May 1976 20 p refs

(AD-A035966; ES-4/76; DRIC-BR-54506) Avail: NTIS HC A02/MF A01 CSCL 06/17

With exposure to the down-draught of a hovering helicopter the surface temperatures of various garment assemblies have been compared, using infrared thermography and the Interim Assembly has been shown to have lowest surface temperature indicating its suitability at heat retention by the body. The surface temperatures observed are seen to be much more uniform in the down-draught than in 'still air' conditions. Thermography reveals the local hot spots over garment assemblies worn in 'still air' conditions. These are the areas where the heat loss will be greatest both in the 'still air' and also when the subjects are exposed to high velocity winds. The very warm areas over the face have been demonstrated in all of the garment assemblies. With the high heat loss coefficients previously measured beneath hovering helicopters, these areas could account for up to 40% of the total body heat loss. Underneath a hovering helicopter an excess temperature of 1 C over any garment assembly can increase heat loss from a subject by upwards of 80 W/sq m. This indicates the sensitivity of heat loss to excess temperature in these environments and emphasizes the importance of adequate and uniform insulating properties of the garment assembly. GRA

N77-26806# Defense Systems Management School, Fort Belvoir, Va.

HUMAN FACTORS CONSIDERATIONS IN NEW GENERATION ARMY AIRCRAFT SYSTEMS

Carl A. Weaver, Jr. Nov. 1976 30 p refs

(AD-A037992) Avail: NTIS HC A03/MF A01 CSCL 01/3

This study is useful to project managers, decision makers and users alike, particularly those interested in rotary-wing system acquisition. It is also useful to behavioral scientists and human factors engineers as an aid to becoming sensitive to user requirements and changes in the operational environment. Purpose, scope and limitations are established. The issues are placed in perspective through a discussion of projected man-machine relationships with respect to the anticipated future operational environment of helicopters. Basic Army aviation systems of the future are described in relation to aviation missions. Projected human factors problems are examined as a function of system performance and operational trends. Human factors are related to life cycle costing by suggesting a relationship between the manager's decision flexibility and a commitment to a final system configuration. It is concluded that a departure from traditional cockpit design is necessary. Recommendations are made concerning decision criteria and human factors-acquisition cycle interface. Author (GRA)

N77-26807# Defense Systems Management School, Fort Belvoir, Va.

HUMAN FACTORS PROGRAMS IN NAVY SYSTEMS ACQUISITION

Stephen C. Merriman Nov. 1976 61 p refs

(AD-A037775) Avail: NTIS HC A04/MF A01 CSCL 05/5

This report examined the role that human factors programs play in Navy systems acquisition. It focused upon the conceptual and validation (advanced development) phases of the acquisition process since it is during this period when the great majority of system design decisions are made. Based upon previous analyses, interview data and the author's personal experience, human factors program activities appropriate to the conceptual and validation phases were identified and discussed relative to key acquisition process milestones; e.g., Development Proposal (DP) and Decision Coordination Paper (DCP) preparation, Defense Systems Acquisition Review Council (DSARC) preparation. Department of Defense and Navy systems acquisition policy was briefly reviewed in terms of its effects on the conduct of human factors programs. Past and present human factors programs were reviewed and critiqued. Current trends and major problem areas were identified and discussed. GRA

N77-26808# IBM Federal Systems Div., Owego, N.Y. Federal Systems Div.

PROGRAM DOCUMENTATION FOR THE T4 EUO CREW STATION SIMULATION PROGRAMS

W. E. Brandt, Jr. Wright-Patterson AFB, Ohio AMRL Feb. 1977 70 p

(Contract F33615-75-C-5152)

(AD-A037944; AMRL-TR-77-6; AMRL-HESS-77-2) Avail: NTIS MF A01 CSCL 05/9

The ALQ-T4 EWO Crew Station Simulation Programs were written for the Crew Station Integration Branch (HED), Human Engineering Division, Aerospace Medical Research Laboratory. The overall function of the entire system of programs is to provide the capability for studying the performance of a trained Electronic Warfare Officer (EWO) during an electronic warfare simulation, to support studies to analyze the impact of the addition of new equipment, and the organization of old equipment on crew performance. A real-time program controls and monitors an AN/ALQ-T4 B-52 EW Crew Station Simulator that has been modified to include a set of equipment changes associated with the Advanced Phase VI B-52 EW Crew Station Project. The subject response times, at which all input transitions occur, and the times that the emitters stations are turned on/off are recorded for subsequent analysis. This sytem was written for an IBM System/370, Model 155 Computer. OS Assembler Language and FORTRAN IV were used in coding the subroutines. GRA

N77-26809# Applied Psychological Services, Wayne, Pa. Science Center.

APPLICATIONS OF HUMAN PERFORMANCE RELIABILITY EVALUATION CONCEPTS AND DEMONSTRATION GUIDELINES Technical Report, 19 Mar. 1976 - 15 Mar. 1977

Arthur I. Siegel, William Rick Leahy, and Joel P. Wiesen 15 Mar. 1977 153 p refs

(Contract N00024-76-C-6126)

(AD-A037632) Avail: NTIS HC A08/MF A01 CSCL 05/5

Although the improvement of equipment systems for human operation and maintenance has been stressed for many years, the actual measurement and specification of human performance reliability in concrete terms has been largely ignored. A set of computer simulation models, which assess the human performance reliability of a system while the system is in the early design state, was previously developed. The results of trial application of these simulation models to an actual system which is under development are presented. Additionally, a set of guidelines is presented which can form the basis for a human performance reliability demonstration in future Navy systems. Author (GRA)

N77-26810# Wyle Labs., Inc., Huntsville, Ala.

PERSONAL FLOTATION DEVICES RESEARCH, PHASE 1 Final Report, Jul. 1975 - Jul. 1976

T. Doll, C. Stiehl, M. Pfauth, and R. MacNeill Jul. 1976 341 p refs

(Contract DOT-CG-42333-A)

(AD-A037221; MSR-76-43; USCG-D-3-77) Avail: NTIS HC A15/MF A01 CSCL 06/7

An Accident Recovery Model (ARM) for recreational boating accidents is presented. Its development and application are described. The model is used to estimate the benefits of regulatory programs in four recovery problem areas. Methods and problems in benefit estimation are described, and recommendations for further development of ARM are offered. An investigation of the causes of sudden and unexplained drownings is reported, including a review of the biomedical literature and an analysis of boating accident reports. Development of the Life-Saving Index (LSI) is described, and its application to the approval of

personal flotation devices (PFDs) is discussed. Past mathematical modeling efforts related to PFD effectiveness are discussed. A pilot experiment is reported, and alternative empirical methods for evaluating PFD effectiveness are presented. A large-scale observational study of PFD wear and accessibility, and a study of PFD-related attitudes and preferences are reported. A preliminary index of PFD wearability is formulated. Initial data on PFD quality control and reliability problems are presented. Procedures for evaluating PFD reliability are outlined. Functions which future PFD designs could fulfill and features of inflatable and hybrid devices are reviewed. Tests of two inflatables and three hybrid devices are reported. Author (GRA)

N77-26811# Navy Clothing and Textile Research Unit, Natick, Mass.

LOW-TEMPERATURE HANDWEAR WITH IMPROVED DEXTERITY Technical Report, 1973 - 1975

Salvatore V. Gianola, Dale A. Reins, and James C. Shampine Dec. 1976 41 p

(AD-A037535; TR-117; TR-2; Rept-6-75) Avail: NTIS HC A03/MF A01 CSCL 06/17

Navy Clothing and Textile Research Facility (NCTRF) conducted tests of second generation models of experimental prototypes which proved superior to the Navy standard in all dexterities and equal in low-temperature environments (-40 F for 2 hours). The best candidate prototype (Type IV, Mod 3) was selected, and a limited number were constructed for field tests at various Alaskan military sites. Test subjects, engaged in a variety of duties involving manual dexterity, rated the experimental glove (Type IV, Mod 3) superior to the standard Navy handwear in all dexterities but less protective at -40 F for extended periods of time (4 hours). A single drawback was that the experimental glove, utilizing a polyurethane foam liner, absorbed excessive moisture (perspiration and melting snow), thus representing a potentially serious hazard. Changes were made to incorporate a moisture barrier lining (Mod 4) and NCTRF conducted in-house tests to ascertain the effect on both low-temperature and manipulatory capabilities. Author (GRA)

N77-26812# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

EFFECTS OF DIRECT SIDE FORCE CONTROL ON PILOT TRACKING PERFORMANCE Final Report, Jan. - Dec. 1975

Donald R. Loose, Kenneth W. McElreath, and George Potor, Jr. Dec. 1976 27 p

(AF Proj. 7222)

(AD-A036083; AMRL-TR-76-87) Avail: NTIS HC A03/MF A01 CSCL 06/19

An experiment was conducted to determine the effects of direct side force motion on a pilot's tracking performance in a simulated air-to-air engagement. Two degrees of control, pitch and lateral velocity, could be commanded by the pilot. Forty-five second runs at various normal G profiles were made with and without dynamic lateral motion, using four subjects. The results showed some degradation of performance at low normal G levels with side motion, but the subjects demonstrated they could easily maintain effective tracking control with + or - 2 Gs of dynamic lateral acceleration. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N77-26813# California Univ., Berkeley. Lawrence Berkeley Lab.

COMPUTER-BASED TRANSPORTABLE DATA ACQUISITION AND CONTROL SYSTEM

Dennis K. Fisher, Michael R. Posehn, Frank L. Sindelar, and Henry H. Bell 30 Sep. 1976 28 p refs Presented at the 47th Shock and Vibration Symp., Albuquerque, N. Mex., 19-21 Oct. 1976

(Contract W-7405-eng-48)

(UCRL-78339; Conf-761062-1) Avail: NTIS HC A03/MF A01

In response to the need for additional data channels, higher data rates, and on-line data processing, a computer-based Transportable Data Acquisition and Control (T-DAC) system was developed. The T-DAC system was designed to perform a wide range of laboratory data acquisition/reduction, and control tasks. A variety of analog and digital I/O devices give process interface flexibility, while a fast 16-bit central processor provides the needed computational power. The use of a high-level language (FORTRAN) permits the rapid development of application software. Applications have included impulse response testing, holographic interferometry, thermal response testing, and electrodynamic vibration shaker control. The development philosophy, hardware configuration, application software, and field experience of the T-DAC system are discussed. ERA

N77-26814# California Univ., Berkeley. Lawrence Berkeley Lab.

METHODOLOGY AND PLANNING FOR A MICROPROCESSOR-ORIENTED REAL TIME CONTROLLER DESIGN AUTOMATION SYSTEM

M. N. Matelan and R. J. Smith, II 4 Nov. 1976 108 p refs

(Contract W-7405-eng-48)

(UCID-17318) Avail: NTIS HC A06/MF A01

A methodology for reducing the complexity of designing dedicated real-time control systems is developed. It is shown that three areas are amenable to automation: the selection and configuration of hardware, the production of software, and the adaptation of a monitor to maintain real-time integrity of the entire system. The concept of hardware binding is introduced, and it is shown that delaying the point in the design cycle where hardware is functionally bound allows a new approach to machine independence. Concepts which allow expression of repetitive control situations are described, and a realization-independent language (CSDL), based on these concepts, is defined. Methods for automatically selecting a time-wise correct monitor are classified, and techniques for specifying the realization capabilities of digital processors are discussed. These concepts and techniques are brought together in a design automation system for the production of a complete controller design from a behavioral description. An example description is traced through the CSD System; a software listing and hardware configuration document for an actual microprocessor is produced. ERA

N77-26815# Sandia Labs., Albuquerque, N. Mex.
USE OF GRAPHICS IN THREE DIMENSIONAL STRUCTURAL ANALYSIS OF SOLIDS
J. H. Biffle 1976 17 p refs Presented at Ann. Meeting of the Amer. Soc. of Mech. Eng., New York, 29 Nov. 1976
(Contract E(29-1)-789)
(SAND-76-9188; Conf-761107-19) Avail: NTIS HC A02/MF A01

In three-dimensional (3D) structural analysis, it essential to have both passive and interactive graphics available. The use of interactive graphics for input generation to finite element analysis is discussed first. The output from the structural code must be plotted effectively for the analyst to understand the results physically. The interactive use of color to display output data can be an important medium in understanding structural output. ERA

N77-26816# Oak Ridge National Lab., Tenn. Energy Div.
INTERNALIZING SOCIAL COSTS IN POWER PLANT SITING: SOME EXAMPLES FOR COAL AND NUCLEAR PLANTS IN THE UNITED STATES
Elizabeth Peelle 1976 27 p refs Presented at the Am. Nuclear Soc. Intern. Meeting, Washington, D.C., 17 Nov. 1976 Sponsored in part by the US Nuclear Regulatory Commission
(Contract W-7405-eng-26)
(CONF-761103-16) Avail: NTIS HC A03/MF A01

Selected aspects of the United States experience in one particular type of energy development project, the siting of nuclear and fossil fueled power generating facilities, are examined in terms of how well community-level impacts are internalized. New institutional arrangements being devised and new requirements being made at local, state, regional, and federal levels in response to these dissociations of cost and benefits from large energy development projects are discussed. Selected examples of these new institutional responses are analyzed for adequacy and significance. ERA

N77-26817# Brookhaven National Lab., Upton, N.Y.
TECHNIQUES OF THREE-DIMENSIONAL RECONSTRUCTION
R. B. Marr, ed. 1974 172 p refs Conf. proc. of an Intern. Workshop held at Upton, N.Y., 16-19 Jul. 1974
(Contract E(30-1)-16; Grant NSF AG-503)
(BNL-20425; Conf-740779) Avail: NTIS HC A08/MF A01

Forty-two short papers representing a wide variety of scientific disciplines but with a common interest on the problem of reconstructing functions in three dimensional space from their projections along various directions onto planes are included. The problem of three-dimensional image reconstruction is of interest in areas such as nuclear medicine, electron microscopy, radio astronomy, holographic interferometry, plasma physics, and radiography. ERA

N77-26818# California Univ., Livermore. Lawrence Livermore Lab.
MONITOR OF DISTRIBUTED DATA SYSTEMS (MODDS). PART 1: DIGEST OF FUNCTIONAL SPECIFICATIONS
E. W. Birss, J. E. Donnelley, and J. W. Yeh 15 Nov. 1976 35 p
(Contract W-7405-eng-48)
(UCID-17314-Pt-1) Avail: NTIS HC A03/MF A01

An approach for improving the use of geographically distributed computer services used by the U. S. Department of Transportation/Transportation Systems Center (DOT/TSC) is described. The interactive use of these distributed services (a major portion of which are data bases) consumes increasing amounts of the DOT user-analyst's time. Accountability, selection capability, usability, and control of distributed services usage is increased by using a minicomputer as an intermediary between the user-analyst and the distributed computer services. Current problems faced by the DOT community are summarized and presented in a digest of MODDS advantages. ERA

N77-26819# California Univ., Livermore. Lawrence Livermore Lab.
RATS OPERATING SYSTEM
C. Landau 13 Oct. 1975 28 p refs
(Contract W-7405-eng-48)
(UCRL-77378) Avail: NTIS HC A03/MF A01

A general purpose timesharing system for the DEC PDP-11/45 computer is described. Although written for a small computer, it incorporates a number of advanced features, including virtual memory, directory hierarchies, capabilities, and C-lists. A type of capability called an entry provides for complete extensibility. These features permitted software designs conducive to security and reliability. ERA

N77-26820# Electronics Engineering Group (1842nd), Richards-Gebaur AFB, Mo.
EVALUATION OF THE BURROUGHS 3500 CRT ENHANCEMENT PROGRAM COMMUNICATIONS SYSTEM
Daniel S. Willett and Jerry R. Barton 31 Jan. 1977 45 p refs
(AD-A037086; Rept-1842-EEG/EETDD-TR-77-12) Avail: NTIS HC A03/MF A01 CSCL 17/2

This report describes the evaluation of the Burroughs 3500 CRT Enhancement Program communications system, performed at Barksdale AFB, La. Included in the report are the results of the evaluation and recommendations to improve the performance of the system. Author (GRA)

N77-26821# Air Force Human Resources Lab., Lowry AFB, Colo.
MICROCOMPUTER CONTROLLED, INTERACTIVE TESTING TERMINAL DEVELOPMENT Final Report, Feb. 1975 - Jun. 1976
Paul J. Kirby and Edward M. Gardner Brooks AFB, Tex. Oct. 1976 24 p
(AF Proj. 1121)
(AD-A035731; AFHRL-TR-76-66) Avail: NTIS HC A02/MF A01 CSCL 05/9

The evolution of a self-contained test scoring terminal is presented. The rationale for the design is presented along with an evolutionary description of the requirements for the system. The sequence of software and hardware tools, which were developed in order to build the device, are also described in this report. The resulting device, which contains an imbedded microcomputer is functionally described and the testing strategies which it currently supports are presented. GRA

N77-26822# Ampex Corp., Redwood City, Calif.
STUDY, TESTS, AND EVALUATION FOR WIDEBAND HIGH-DENSITY DATA ACQUISITION (WHIDDA) Final Technical Report, Apr. 1975 - Mar. 1976
Charles F. Spitzer, Theodore A. Jensen, and John M. Utschig Wright-Patterson AFB, Ohio AFAL Jan. 1977 115 p refs
(Contract F33615-75-C-1192)
(AD-A037410; EP-7356; AFAL-TR-76-115) Avail: NTIS HC A06/MF A01 CSCL 14/3

The forceful trend toward recording wideband analog signals on high-density digital recorders requires the most careful assessment of the limiting parameters of this process. It has been established that the bit-error rate of the reproduced digital signal is often critically dependent on the pattern sensitivity of the chosen recording code. Since the digitized analog signals usually exhibit strong data patterning, such pattern sensitivity may have devastating effects on the bit-error rate of the system. The broad and basic objective of this program was the impartial assessment and comparison of the Miller code (also known as delay modulation code) and the Modified NRZ code (with insertion of the inverted seventh bit as an eighth bit), for bit packing densities of 10, 20, 30, 40, and 50 Kb/in., each case being tested with pseudorandom words of 63, 511, and 1,023 bits and with 6-bit words representing a sampled ramp function, and repeated 32, 64, and 128 times, respectively. GRA

N77-26823# Mitre Corp., Bedford, Mass.
GEOGRAPHIC DATA BASE DEVELOPMENT
A. M. Molloy Jan. 1977 186 p refs
(Contract F19628-76-C-0001)
(AD-A037116; MTR-3312; ESD-TR-76-360) Avail: NTIS HC A09/MF A01 CSCL 08/2

Project 7090, Operations/Intelligence Techniques Experimentation, has as an objective the development of data processing techniques for effective applications of intelligence data. Because information derived from intelligence data is often positional,

one way to derive information is to display the data over a map background. Although map data bases for the world have already been digitized, in order that a map background be effective in an operational environment, there must be a direct relationship between the amount and types of map feature data displayed, and the scale of the display. This report discusses the issues involved in creating custom data bases and provides documentation on the set of FORTRAN routines implemented for that purpose. Author (GRA)

N77-26824# Arizona Univ., Tucson. Dept. of Chemistry.
THREADED CODE FOR LABORATORY COMPUTERS Technical Report, 1 Feb. 1974 - 1 Feb. 1977
J. B. Phillips, M. F. Burke, and G. S. Wilson 7 Feb. 1977 17 p refs Submitted for publication
(Contract N00014-75-C-0512; NR Proj. 051-518)
(AD-A037190; TR-8) Avail: NTIS HC A02/MF A01 CSCL 09/2

A typical minicomputer has been transformed into a threaded code machine by the addition of a simple, fast interpreter implemented in microcode. When made directly available to the programmer, the threaded code programming technique is a very convenient and efficient means of structuring programs, particularly in systems where programs are continually being modified. GRA

N77-26825# Electronics Engineering Group (1842nd), Richards-Gebaur AFB, Mo. Digital Network Systems Facility.
A MICROPROCESSOR-BASED BIT ERROR PERFORMANCE MONITOR Final Report
James R. Hammer Dec. 1976 25 p refs
(AD-A037612; Rept-1842-EEG/EETET-TR-77-10) Avail: NTIS HC A02/MF A01 CSCL 09/2

This report describes one approach in realizing a digital communication system performance monitor which utilizes microprocessor technology and selected algorithms to process and display bit error parameters based on detected errors in a digital communication system. Author (GRA)

N77-26826# Harry Diamond Labs., Adelphi, Md.
GRAPHELP USER'S MANUAL: VERSION 2
Steven Choy Mar. 1977 60 p
(HDL Proj. 898C81)
(AD-A037564; HDL-TM-77-2) Avail: NTIS HC A04/MF A01 CSCL 09/2

An interactive-graphics, minicomputer-based, FORTRAN IV, software package called GRAPHELP has been developed. The current GRAPHELP software package has working versions implemented on three different minicomputer systems providing interactive graphics support for all Tektronix 401X graphics storage tube terminals and the Imlac PDS-4 refresh graphics display system. The software package provides both absolute and relative vectors of four varying line textures, user definable scaling, windowing, clipping, terminal transparency, and 128 nested subpicture display files for refresh graphics. In addition, routines are provided for interactive graphics crosshair input, interactive screen erase control, and selective erase to aid users in building their own interactive graphics display programs with GRAPHELP as the foundation. For those applications that are oriented toward data plotting rather than picture drawing, axes and scaling routines for both linear and logarithmic data are provided, along with alphabetic and numeric symbol output. This document both describes the software capabilities and provides instructions on its use. Author (GRA)

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N77-26827*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OPTIMIZATION GUIDE FOR PROGRAMS COMPILED UNDER IBM FORTRAN H (OPT=2)
D. M. Smith, A. H. Dobyns, and H. M. Marsh Apr. 1977 174 p refs Prepared in cooperation with Boole and Babbage, Inc., Sunnyvale, Calif.
(NASA-TM-X-71307; X-530-77-72) Avail: NTIS HC A08/MF A01 CSCL 09B

Guidelines are given to provide the programmer with various techniques for optimizing programs when the FORTRAN IV H compiler is used with OPT=2. Subroutines and programs are described in the appendices along with a timing summary of all the examples given in the manual. Author

N77-26828*# Science Applications, Inc., Huntsville, Ala.
NASA SOFTWARE SPECIFICATION AND EVALUATION SYSTEM: SOFTWARE VERIFICATION/VALIDATION TECHNIQUES Final Report
22 Apr. 1977 60 p
(Contract NAS8-31554)
(NASA-CR-150299; SAI-78-556-HU) Avail: NTIS HC A04/MF A01 CSCL 09B

NASA software requirement specifications were used in the development of a system for validating and verifying computer programs. The software specification and evaluation system (SSES) provides for the effective and efficient specification, implementation, and testing of computer software programs. The system as implemented will produce structured FORTRAN or ANSI FORTRAN programs, but the principles upon which SSES is designed allow it to be easily adapted to other high order languages. Author

N77-26829*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOLUTION OF TRANSIENT OPTIMIZATION PROBLEMS BY USING AN ALGORITHM BASED ON NONLINEAR PROGRAMMING
Fred Teren 1977 13 p refs Presented at Joint Autom. Control Conf., San Francisco, 22-24 Jun. 1977
(NASA-TM-X-73618; E-9107) Avail: NTIS HC A02/MF A01 CSCL 09B

An algorithm is presented for solution of dynamic optimization problems which are nonlinear in the state variables and linear in the control variables. It is shown that the optimal control is bang-bang. A nominal bang-bang solution is found which satisfies the system equations and constraints, and influence functions are generated which check the optimality of the solution. Nonlinear optimization (gradient search) techniques are used to find the optimal solution. The algorithm is used to find a minimum time acceleration for a turbofan engine. Author

N77-26830# Pennsylvania Univ., Philadelphia. Wharton School of Finance and Commerce.
WAND USER'S GUIDE Final Report
Rob Gerritsen, Ricardo Cortes, Jim Ribeiro, and Ruth Zowader 15 Apr. 1976 47 p
(Contract N00014-75-C-0462)
(AD-A037436; Rept-76-01-03) Avail: NTIS HC A03/MF A01 CSCL 09/2

This guide presents the basic concepts of WAND, a Database Management System. The first section presents the major concepts and terminology of WAND. It also introduces the Data Description Language (DDL) and the Data Manipulation Language (DML). The second section describes in detail the DDL and the procedures used to create the schema. The third section contains the DML statements and several examples illustrating their use. Author (GRA)

N77-26831# Pennsylvania Univ., Philadelphia. Wharton School of Finance and Commerce.
WAND USER'S GUIDE. ADDENDUM Final Report
Michael D. Zisman 21 May 1976 22 p
(Contract N00014-75-C-0462)
(AD-A037335; Rept-76-05-08) Avail: NTIS HC A02/MF A01 CSCL 09/2

This report presents a description of the COBOL based data manipulation language (DML) of the WAND system and a description of all commands as well as examples of their use. GRA

N77-26832# Pennsylvania Univ., Philadelphia. Wharton School of Finance and Commerce.

WAND DEMONSTRATION Final Report
Rob Gerritsen and Howard L. Morgan Jun. 1976 16 p Presented at the SIGMOD Conf., Washington, D. C., 2-4 Jun. 1976
(Contract N00014-75-C-0462)
(AD-A037199; Rept-76-06-01) Avail: NTIS HC A03/MF A01 CSCL 09/2

A demonstration of the online interactive user interface in the WAND system. Various features are demonstrated including an interactive data manipulation language, a bootstrapping HELP facility, and schema browsing commands. WAND is a plex DBMS fashioned after the CODASYL database task group (DBTG) specifications. Author (GRA)

N77-26833# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
ABSTRACTION AND VERIFICATION IN ALPHARD: INTRODUCTION TO LANGUAGE AND METHODOLOGY Interim Report
William A. Wulf, Ralph L. London, and Mary Shaw 14 Jun. 1976 50 p refs
(Contract F44620-73-C-0074; DAHC15-72-C-03-08)
(AD-A035487; AFOSR-77-0052TR) Avail: NTIS HC A03/MF A01 CSCL 09/1

ALPHARD is a programming language whose goals include supporting both the development of well-structured programs and the formal verification of these programs. This paper attempts to capture the symbiotic influence of these two goals on the design of the language. To that end the language description is interleaved with the presentation of a proof technique and discussion of programming methodology. Examples to illustrate both the language and the verification technique are included. Author (GRA)

N77-26834# California Univ., Berkeley. Lawrence Berkeley Lab.
SIMULATION OF THE PERFORMANCE OF A COLLECTION OF STORAGE SPACE ALLOCATION ALGORITHMS
Joseph C. Nichols 23 Sep. 1976 22 p refs
(Contract W-7405-eng-48)
(UCID-17251) Avail: NTIS HC A02/MF A01

Storage algorithms for reserving and freeing contiguous blocks of storage space were investigated. A simulation program was constructed and run for each method; several different distributions of the parameters that characterize the request for storage space were used. The performance of a noncontiguous storage algorithm was simulated for comparison with the other methods. The effect of disk flaws on the performance of several algorithms was also simulated. The simulation runs showed that the algorithm currently in use at LLL performs best for theoretical distributions of file size and life but that it is not best-suited for the distributions of size and life drawn from the samplings of the LLL machines. The results did not indicate a better-suited choice for the LLL data because samples from different LLL systems resulted in different rankings among the various algorithms. GRA

N77-26835# California Univ., Berkeley. Lawrence Berkeley Lab.
HOW TO USE THE CDC 6600 G-MACHINE FROM A REMOTE TERMINAL
G. P. Ledbetter 15 Jul. 1976 25 p refs
(Contract W-7405-eng-48)
(UCID-30095) Avail: NTIS HC A02/MF A01

Lawrence Livermore Laboratory's CDC 6600 G-machine can be timeshared by newly hired employees not yet cleared for access to the main computer system and by distant computer users (through dial-up telephone connections). Sufficient instruction is given to enable such users to log onto the G-machine, run their problem programs and related utility programs, make inquiries and understand computer responses about the state of running programs, and generally understand what's happening. ERA

N77-26836# California Univ., Berkeley. Lawrence Berkeley Lab.
TRIX AC: A SET OF GENERAL PURPOSE TEXT EDITING COMMANDS
A. Cecil, H. Moll, and J. Rinde 27 Oct. 1976 60 p refs
(Contract W-7405-eng-48)
(UCID-30040(ED.8)) Avail: NTIS HC A04/MF A01

The AC dialect of the TRIX language is used at LLL to create and edit text files. This report describes all the commands in the AC dialect of TRIX. It is a very convenient reference document for users who are already familiar with TRIX AC. On the CDC 7600 computer at LLL, the AC dialect is invoked by the execute line TRIX AC, which calls up the TRIX interpreter and invokes the AC command set. This document supersedes all previous editions of UCID-30040. ERA

N77-26837# California Univ., Berkeley. Lawrence Berkeley Lab.
USER'S GUIDE FOR THE STAR-100
Gail Whitten 4 May 1976 38 p refs
(Contract W-7405-eng-48)
(UCID-30133) Avail: NTIS HC A03/MF A01

A description is given of how to generate, run, and debug a controllee, and send out files. The procedures are for the STAR-100 computers at Lawrence Livermore Laboratory. Available software is tabulated. ERA

N77-26838# Sandia Labs., Albuquerque, N. Mex.
ACCURACY PROPERTY OF CERTAIN HYPERBOLIC DIFFERENCE SCHEMES
D. L. Hicks and M. M. Madsen Dec. 1976 84 p refs
(Contract E(29-1)-789)
(SAND-76-0389) Avail: NTIS HC A05/MF A01

An accuracy property called the CFL1 property is shared by several successful difference schemes. It appears to be a property at least as important as the property of higher-order accuracy for hyperbolic difference schemes when weak solutions (e.g., shocks) are sought. Investigation of this property leads to suggestions of ways to improve the accuracy in such wavecodes as WONDY, CHARTD, and THREEDY. ERA

N77-26839# California Univ., Livermore. Lawrence Livermore Lab.
PRELIMINARY DOCUMENTATION OF GEARBI: SOLUTION OF ODE SYSTEMS WITH BLOCK-ITERATIVE TREATMENT OF THE JACOBIAN
A. C. Hindmarsh Dec. 1976 16 p refs
(Contract W-7405-eng-48)
(UCID-30149) Avail: NTIS HC A02/MF A01

A preliminary version of documentation for the GEARBI package is presented. The package solves systems of ordinary differential equations (initial value problem), with emphasis on stiff systems, in which the Jacobian matrix has a regular block structure. The package takes advantage of that structure and uses a block-iterative (block-SOR) method to solve the linear algebraic systems that arise. In all other respects, GEARBI is much the same as the GEAR package. An earlier version of GEARBI was used for atmospheric kinetics transport problems in one and two dimensions. ERA

N77-26840# California Univ., Livermore. Lawrence Livermore Lab.
TWO-DIMENSIONAL DELTA-MOD FACSIMILE CODING
J. W. Woods 25 Mar. 1976 15 p refs Presented at Natl. Telecommunications Conf., Dallas, 29 Nov. 1976
(Contract W-7405-eng-48)
(UCRL-77999; Conf-761113-1) Avail: NTIS HC A92/MF A01

A new facsimile source coding algorithm is presented, two dimensional delta-mod facsimile coding. The algorithm is based on conventional run lenght coding. Additional compression is achieved by vertically delta modulating the horizontal run lengths. The delta modulation introduces a distortion into the image which can be traded off versus the rate of transmission. Cumulative error is prevented, as in conventional delta-mod by including the quantizer in the feedback loop. Preliminary results are presented. ERA

N77-26841# European Space Research and Technology Center, Noordwijk (Netherlands).
CNESRO, CNSIM-CNSTAT PROGRAMS FOR THE STUDY OF THE MAINTENANCE AND AVAILABILITY OF A SPACE SYSTEM. VOLUME 1: PROBLEM ANALYSIS AND PROGRAM REALISATION

J. C. Debruyn Paris ESA Feb. 1977 100 p refs 2 Vol.
(ESA-TM-174-Vol-1) Avail: NTIS HC A05/MF A01

A simulation and a statistical program were developed for studying the maintenance and availability of a geosynchronous satellite system. The CNESRO simulation program takes into account the number of launches necessary, reliability and space segment price, replenishment policy, orbital configuration, and satellite structures. The CNSIM program is the same as CNESRO but enhanced with regard to launch data. The CNSTAT statistical program covers the same items statistically as CNESRO and is enhanced with extended statistics regarding interval inside the simulated period, number/length of breakdowns per run, and conditional probability tables. ESA

N77-26842# European Space Research and Technology Center, Noordwijk (Netherlands).

CNESRO, CNSIM-CNSTAT PROGRAMS FOR THE STUDY OF THE MAINTENANCE AND AVAILABILITY OF A SPACE SYSTEM. VOLUME 2: USER'S GUIDE

J. C. Debruyn Paris ESA Feb. 1977 71 p 2 Vol.
(ESA-TM-174-Vol-2) Avail: NTIS HC A04/MF A01

Simulation and statistical programs were developed for studying the maintenance and availability of a geosynchronous satellite system. A user manual is presented for the programs. It includes input guides, lists of error messages, a list of the maximum dimension of the system, and an operations guide. ESA

N77-26843# Oxford Univ. (England). Dept. of Engineering Science.

EXTENDED SYSTEM MODELLING PROGRAM - ESMP. SIMULATION OF A LARGE ANALOGUE COMPUTER ON A PDP 11

D. W. Clarke 1976 54 p refs
(OUEL-1178/76) Avail: NTIS HC A04/MF A01

The extended system modelling program ESMP for simulating continuous dynamic processes, is described, and its implementation on a PDP 11 is detailed. The program uses a block-oriented structure to describe systems, rather like that of an analog computer patching diagram, and the keyboard data entry and graphical display allow the user to develop and test his system model rapidly and accurately. The program is an adaptation and enhancement of IBM 1130 CSMP, making it feasible to handle more complex processes and obviating the need for an analog computer in many types of investigation, particularly when several nonlinear elements are required. ESA

N77-26844# Intermetrics, Inc., Cambridge, Mass.

CANDIDATE LANGUAGES EVALUATION REPORT Final Report, Oct. 1975 - Jan. 1977

Benjamin M. Brosgol, Robert E. Hartman, John R. Nestor, Martin S. Roth, and Laurence M. Weissman Jan. 1977 535 p refs 2 Vol.
(Contract DAHC26-76-C-0006)
(AD-A037639; IR-217; USACS-AT-76-11) Avail: NTIS HC A23/MF A01 CSCL 09/2

The main purpose of this report is to perform an evaluation of six High Order Languages - TACPOL, CS-4, Jovial J73/I, FORTRAN, COBOL, and PL/1-with respect to the Department of Defense Requirements for High Order Computing Programming Languages 'Tinman'. These requirements were determined in a previous report to be consistent with the needed programming language charactersitics applications. An evaluation tool is developed to assist in the investigation of the technical merit of the candidate languages, and management decision-making criteria are derived which take non-technical factors into account. The fundamental result of this study is that, among the six HOL's considered, CS-4 comes closest to satisfying the Tinman requirements. The reason for the closeness of fit is that the language objectives receiving high priority in the Tinman (reliability, maintainability, readability) are also basic design goals of CS-4. This report recommends CS-4 as a suitable basis for a common DOD language. Because of fundamental shortcomings in each of the other five HOL's, this report recommends that these HOL's not be used as the basis for a common language. Author (GRA)

N77-26845# IBM Federal Systems Div., Gaithersburg, Md.

CANDIDATE LANGUAGE EVALUATION AND RECOMMENDATION REPORT

1977 145 p 2 Vol.
(Contract F30602-77-C-0009)
(AD-A037638) Avail: NTIS HC A07/MF A01 CSCL 09/2

This report contains comparisons between three existing High-Order Languages (HOL) - COBOL, FORTRAN and HAL/S - and the DoD identified HOL requirements for embedded computers as published in the Requirements for High-Order Computer Programming Languages TINMAN June 1976. FORTRAN and COBOL are standard DoD High-Order Programming Languages, which address scientific and business programming. HAL/S is a NASA-designed HOL for use on the On-Board Shuttle and other computers. The study was performed for Rome Air Development Center, in support of DoD's HOL cost reduction project through HOL standardization. The results of this study show that FORTRAN meets relatively few of the requirements for a HOL for embedded computers. COBOL meets a much larger number of the TINMAN requirements and is particularly readable (and hence maintainable) because of its resemblance to English. HAL/S was designed for programming embedded computers and satisfies an even larger number of the TINMAN requirements than COBOL. The limited number of implementations speaks both for and against HAL/S: it is not widely known and used, but it has a very high degree of standardization. GRA

N77-26846# Naval Postgraduate School, Monterey, Calif.

VERIFICATION AND FEASIBILITY STUDY OF A MICRO-COMPUTER BASED BALLISTICS ALGORITHM M.S. Thesis

John Thomas Ertlschweiger, II Dec. 1976 248 p refs
(AD-A036062) Avail: NTIS HC A11/MF A01 CSCL 09/2

The radical cost reductions in computer hardware brought about by large scale integration (LSI) has motivated this feasibility study which explores the use of the INTEL 8080 as a ballistics computer in a distributed micro-computer based air-borne tactical weapons system. The results show that software floating point arithmetic using a sixteen bit mantissa is sufficiently accurate for solving the ballistics problem. Experimental data failed to show that mathematical model accurately predicts the weapon's behavior. Either the instrumentation to record the release data was inaccurate, or the ballistics tables do not accurately predict the actual behavior of falling weapons. GRA

N77-26847# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

STRUCTURED PLANNING AND DEBUGGING. A LINGUISTIC THEORY OF DESIGN

Ira P. Goldstein and Mark L. Miller Dec. 1976 87 p refs Revised
(Contracts N00014-75-C-0643; NSF C-40708)
(AD-A036815; AI-M-387; Logo-M-34) Avail: NTIS HC A05/MF A01 CSCL 05/7

A unified theory of planning and debugging is explored by designing a problem solving program called PATN. PATN uses an augmented transition network (ATN) to represent a broad range of planning techniques, including identification, decomposition, and reformulation. (The ATN is a simple yet powerful formalism which has been effectively utilized in computational linguistics). PATN's plans may manifest 'rational bugs', which result from heuristically justifiable but incorrect arc transitions in the planning ATN. This aspect of the theory is developed by designing a complementary debugging module called DAPR, which would diagnose and repair the errors in PATN's annotated plans. The investigation is incomplete; PATN has not yet been implemented. But sufficient detail is presented to provide a theoretical framework for reconceptualizing Sussman's HACKER research. Since a detailed study of planning and debugging techniques is a prerequisite for complete fulfillment of Dijkstra's objectives of program reliability, readability, portability, and so on, the theory is called, 'Structured Planning and Debugging', to emphasize its potential role in this enterprise. GRA

N77-26848# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

OVERVIEW OF A LINGUISTIC THEORY OF DESIGN

Mark L. Miller and Ira P. Goldstein Dec. 1976 32 p refs

(Contracts N00014-75-C-0643; NSF C-40708)
(AD-A036915; AI-M-383; Logo-M-30) Avail: NTIS HC A03/MF A01 CSCL 05/7

SPADE is a theory of the design of computer programs in terms of complementary planning and debugging processes. An overview of the author's recent research on this theory is provided. SPADE borrows tools from computational linguistics -- grammars, augmented transition networks (ATN's), chart-based parsers -- to formalize planning and debugging. The theory has been applied to parsing protocols of programming episodes, constructing a grammar-based editor in which programs are written in a structured fashion. Author (GRA)

N77-26849# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
QUANTITATIVE METHODS FOR SOFTWARE RELIABILITY MEASUREMENTS Final Report, 1 Dec. 1973 - 30 Nov. 1976
Paul B. Moranda Dec. 1976 200 p refs
(Contract F44620-74-C-0008)
(AD-A035585; MDC-G6553; AFOSR-77-0046TR) Avail: NTIS HC A09/MF A01 CSCL 09/2

This research effort in the field of software reliability is primarily based on probability, as applied to error detection rates as applied to the generation of input tests data, and as applied to the economics of random versus constructed test cases. The background description of the flow of computations is made by means of a directed graph representation and a connection matrix depicting possible links between program segments. Random numbers selected from a given domain by several distributions are employed as input to programs instrumented to detect the use of the program's segments. An alogrithm is employed to estimate the total number of execution sequences which are likely to be eventually driven by random number inputs, and, by implication, the point in testing where the change to constructed cases should be made. Modes for determining the count of these execution sequences are described and tables which facilitate estimation of the number of logical paths and related parameters are provided for convenience. Author (GRA)

N77-26850# California Univ., Berkeley. Operations Research Center.
EVERYMAN'S GUIDE TO TIMES
Randall R. Willie Jan. 1977 101 p refs
(Grant AF-AFOSR-3179-77)
(AD-A035733; ORC-77-2) Avail: NTIS HC A06/MF A01 CSCL 12/1

Computer programming, Time series analysis, Forecasting, Transfer functions, Mathematical models, Curve fitting, FORTRAN, Plotting times computer program, Box- Jenkins method, Fast Fourier transform this is a user's manual for the times computer program, an integrated system of FORTRAN subroutines for modelling of a single time series and for transfer function modelling with a single input series. TIMES is an extension and adaptation of a widely used system available from the Ohio State University Computer Center Library. This document is a refinement of an earlier guide prepared for classroom use during Spring Quarter, 1976, at the Department of Industrial Engineering and Operations Research, University of California, Berkeley. GRA

N77-26851# Colorado State Univ., Fort Collins. Dept. of Mathematics.
A COMBINED REMES-DIFFERENTIAL CORRECTION ALGORITHM FOR RATIONAL APPROXIMATION Interim Report
Edwin H. Kaufman, Jr., David J. Leeming, and G. D. Taylor Nov. 1976 33 p refs
(Grant AF-AFOSR-2878-76)
(AD-A037667; AFOSR-77-0165TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this paper a hybrid Remes-differential correction algorithm for computing best uniform rational approximants on a compact subset of the real line is developed. This algorithm differs from the classical multiple exchange Remes algorithm in two crucial aspects. First of all, the solving of a nonlinear system to find a best approximation on a given reference set in each iteration of the Remes algorithm is replaced with the differential correction algorithm to compute the desired best approximation on the reference set. Secondly, the exchange procedure itself has been modified to eliminate the possibility of cycling that can occur in the usual exchange procedure. This second modification is necessary to guarentee the convergence of this algorithm on a finite set without the usual normal and sufficiently dense assumptions that exist in other studies. Author (GRA)

N77-26852# Washington Univ., Seattle. Dept. of Mathematics.
NONLINEAR OPTIMIZATION AND GENERALIZED LAGRANGE MULTIPLIERS Final Scientific Report, 1 Jan. 1971 - 31 Dec. 1976
R. Tyrrell Rockafellar 19 Feb. 1977 7 p refs
(Grant AF-AFOSR-2269-72)
(AD-A037560; AFOSR-77-0184TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Thirty-one articles and one monograph published under this grant are described. These are grouped as follows: nonlinear programming (9 articles), stochastic programming (9 articles), optimal control (8 articles), convex analysis/integral functionals (5 articles and one monograph). Author (GRA)

N77-26853# Harris Corp., Melbourne, Fla. Electronic Systems Div.
MULTIPLEX SIMULATOR DESIGN STUDY Final Technical Report, Apr. 1973 - Jun. 1976
Jaime A. Gracia Wright-Patterson AFB, Ohio AFAL Jan. 1977 180 p refs
(Contract F33615-73-C-1172)
(AD-A037226; AFAL-TR-76-201) Avail: NTIS HC A09/MF A01 CSCL 09/4

This report covers the definition, design, and development of MUXSIM (Multiplex Systems Simulator), a software package which performs computer-aided design and design verification of digital information transfer/multiplex systems. MUXSIM is primarily an aid for an organized approach at specifying and designing multiplex systems for diverse applications. It is a tool for obtaining answers to some complex digital multiplex system implementation problems, such as command and control techniques for data transfer, data bus requirements, system interface hardware requirements, and data processing and manipulation requirements. The simulator is capable of adapting to new workload requirements and system configurations, as well as handling unknowns through employment of FORTRAN, GASP, and a simulator utility package. Author (GRA)

62 COMPUTER SYSTEMS

Includes computer networks.

N77-26854# National Physical Lab., Teddington (England). Div. of Computer Science.
SECOND EUROPEAN USERS' WORKSHOP ON NETWORK PROTOCOLS
Nov. 1976 103 p refs Proc. of conf. held at Teddington, Engl., 7-8 Oct. 1976 Sponsored by Computer Systems and Electron. Requirements Board
(NPL-Com-84) Avail: NTIS HC A06/MF A01

Topics covered in the presentations and discussions were: network architecture, 'transport station' services (end-to-end protocols), virtual terminal issues, and file transfer protocols. For individual titles, see N77-26855 through N77-26859.

N77-26855# National Physical Lab., Teddington (England).
PRESENT STATUS OF COMPUTER NETWORKS: AN OVERVIEW
R. A. Scantlebury *In its* Second European Users' Workshop on Network Protocols Nov. 1976 7 p (For primary document see N77-26854 17-62)
Copyright. Avail: NTIS HC A06/MF A01

The present status of packet switching computer networks, together with their attendant protocols and interfaces, and the need for standardization are briefly touched on. ESA

N77-26856# Institut fuer Datenfernverarbeitung, GMD, Darmstadt (West Germany).

AN ARCHITECTURAL APPROACH TO X25
E. Raubold *In* Natl. Phys. Lab. Second European Users' Workshop on Network Protocols Nov. 1976 24 p (For primary document see N77-26854 17-62)
Copyright. Avail: NTIS HC A06/MF A01

In order to provide a systematic way of defining virtual call or datagramm protocols and their possible combinations the following are identified: two different channel types and corresponding procedures, a set of functional options for these channels, and a hierarchy of functional levels necessary to control transportation of data through a communication subsystem. ESA

N77-26857# Atomic Energy Research Establishment, Harwell (England). Computer Science and Systems Div.
TOWARDS A UNIFIED VIEW OF HIGH LEVEL PROTOCOLS
K. S. Heard and A. Langsford *In* Natl. Phys. Lab. Second European Users' Workshop on Network Protocols Nov. 1976 19 p (For primary document see N77-26854 17-62)
Copyright. Avail: NTIS HC A06/MF A01

Three aspects of unifying high level protocols are discussed: a top down description of the architecture, a technique for representing all function oriented protocols, and a set of primitive operations required to access the transport function. ESA

N77-26858# Institut de Recherche d'Informatique et d'Automatisme, Roquencourt (France).
TERMINAL ACCESS PROTOCOLS ON EURONET
H. Zimmermann *In* Natl. Phys. Lab. Second European Users' Workshop on Network Protocols Nov. 1976 6 p refs (For primary document see N77-26854 17-62)
Copyright. Avail: NTIS HC A06/MF A01

A brief description and analysis of the present state of terminal access protocols in the European information retrieval (EURONET) is presented. ESA

N77-26859# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
PROPOSAL FOR A SCROLL MODE VIRTUAL TERMINAL IN EUROPEAN INFORMATICS NETWORK
P. Schicker and H. Zimmermann *In* Natl. Phys. Lab. Second European Users' Workshop on Network Protocols Nov. 1976 17 p refs (For primary document see N77-26854 17-62)
(EIN/CCG/76/008) Copyright. Avail: NTIS HC A06/MF A01

The notion of a standard virtual terminal and the specifications for driving it in scroll mode are defined. ESA

N77-26860# Pennsylvania Univ., Philadelphia. Dept. of Decision Sciences Management.
ALERTERS ON NETWORK DATABASES Final Report
Stanley F. Cohen Dec. 1976 59 p refs
(Contract N00014-75-C-0462)
(AD-A037438; Rept-77-02-07) Avail: NTIS HC A04/MF A01 CSCL 09/2

This thesis describes a system for alerting on network databases which consists of a simple sharable data management system with a facility for the user to create event-driven procedures called demons. A discussion is included of related work in database systems and artificial intelligence. Author (GRA)

N77-26861# Pennsylvania Univ., Philadelphia. Wharton School of Finance and Commerce.
ALERTING IN DATABASE SYSTEMS: CONCEPTS AND TECHNIQUES Final Report
Howard Lee Morgan and O. Peter Buneman Jun. 1976 22 p refs
(Contract N00014-75-C-0462)
(AD-A037437; Rept-75-12-04) Avail: NTIS HC A02/MF A01 CSCL 09/2

This paper discusses the subject of alerters, which can be used in a database management system to provide the same capability of informing a user when a specified state of the world (as reflected in the database) is reached. This paper describes recent research in adding alerting features to database management systems and provides a framework within which this research can be evaluated. GRA

N77-26862# Pennsylvania Univ., Philadelphia. Wharton School of Finance and Commerce.
AN ALERTING SYSTEM FOR A DATABASE MANAGEMENT SYSTEM M.S. Thesis. Final Report
Richard Cortes Dec. 1976 46 p
(Contract N00014-75-C-0462)
(AD-A037201; Rept-77-01-06) Avail: NTIS HC A03/MF A01 CSCL 09/2

This thesis describes an alerting system for a Database Management System which provides the end users with the facilities to monitor in a dynamic fashion the changes being made on the information, in order to perform some predetermined actions whenever certain conditions become true. The work includes the description of a simplified implementation of an alerting system made on the Wharton Alerting Network Database (WAND) which gives the foundation for a full implementation on a properly shared database system of the kind described by CODASYL DATABASE TASK GROUP in its April 71 report. Author (GRA)

N77-26863# Brookhaven National Lab., Upton, N.Y.
CRYSNET MANUAL Informal Report
Jul. 1976 633 p
(Contract E(30-1)-16; Grants NSF-G-DCR-75-07702; NSF-G-GJ-22348X)
(BNL-21714) Avail: NTIS HC A99/MF A01

This manual describes the hardware and software which together make up the crystallographic computing network (CRYSNET). The manual is intended as a users' guide and also provides general information for persons without any experience with the system. CRYSNET is a network of intelligent remote graphics terminals that are used to communicate with the CDC Cyber 70/76 computing system at the Brookhaven National Laboratory (BNL) Central Scientific Computing Facility. Terminals are in active use by four research groups in the field of crystallography. A protein data bank was established at BNL to store in machine-readable form atomic coordinates and other crystallographic data for macromolecules. The bank currently includes data for more than 20 proteins. This structural information can be accessed at BNL directly by the CRYSNET graphics terminals. More than two years of experience was accumulated with CRYSNET. ERA

N77-26864# Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.
FEASIBILITY STUDY OF NETWORKS Progress Report, 15 Jul. - 14 Dec. 1976
E. J. Campbell 15 Oct. 1976 62 p
(Contract EY-76-S-02-2487)
(COO-2487-4) Avail: NTIS HC A04/MF A01

Current experiments being performed on the ARPANET in collaboration with the Lawrence Berkeley Laboratory are described. The use of mail and teleconferencing systems such as TDA and PLANET is compared. Plans for future experiments on the ARPANET, for expansion of compter-aided communication facilities, and for investigation of networks other than the ARPANET are proposed. The conclusion is that resource sharing via networks in both feasible and desirable, provided certain interface problems are solved. Recommendations are made for more investigation into the human factors involved in network use, methods of providing consulting help to users, and determination of the most cost-effective use of remote resource sharing. For the Laboratory for Nuclear Science, it was concluded that access to other ERDA computers via networks will meet some of the computing needs now and more in the future. ERA

N77-26865# Los Alamos Scientific Lab., N. Mex.
LASL INTEGRATED COMPUTER NETWORK
D. E. Tolmie 1976 13 p refs Presented at Network Systems Corporation Users Symp. Minneapolis, Minn., 16 Sep. 1976
(Contract W-7405-eng-36)
(LA-UR-76-2321; Conf-760972-1) Avail: NTIS HC A02/MF A01

PDP-11 minicomputers are used extensively for networking a set of large scientific computers used for both batch and time-sharing applications. The LASL Central Computing Facility network configuration is described. ERA

N77-26866# Los Alamos Scientific Lab., N. Mex.
COMPUTER INTERFACING AT LASL
J. A. Brockmeyer and A. G. Dornhoff 1976 26 p Presented at Conf. of the Assoc. of ERDA Systems, Operations and Programs, Denver, Colo., 28 Sep. 1976
(Contract W-7405-eng-36)
(LA-UR-76-2502; Conf-760934-6) Avail: NTIS HC A03/MF A01

The network, the hardware interfaces used to implement it, and plans for future improvements are described. Specific hardware taken up include the following: PDP-11 UNIBUS interface; PDP-11 link-the RTLI; the 6000 link-the PDP-11 coupler; the 6000 link-the 6000 synchronizer; and the 7600 link-the 7600 synchronizer. Two of the most significant improvements will be the addition of the file transport subsystem and the addition of one or more class 6 computers. A CRAY-1 computer system currently undergoing evaluation is described. ERA

N77-26867# Sandia Labs., Albuquerque, N. Mex. Aerodynamics Simulation Div.
EVALUATION OF A CORRECTION METHOD FOR DIGITAL COMPUTER LAG IN HYBRID SYSTEMS
Warren H. Curry Dec. 1976 34 p refs
(Contract E(29-1)-789)
(SAND-76-0343) Avail: NTIS HC A03/MF A01

First-and second-order corrections are applied to the analog readings used in the digital computations in hybrid systems, and the results are experimentally determined. Also investigated is the effect of converting digital-to-analog converter output to linear ramp segments. ERA

N77-26868# California Univ., Livermore. Lawrence Livermore Lab.
USER'S GUIDE TO THE OCTOPUS COMPUTER NETWORK (THE SHOC MANUAL)
C. Schneider, D. Thompson, and G. Whitten 7 Oct. 1976 82 p refs
(Contract W-7405-eng-48)
(UCID-30048-Rev-3) Avail: NTIS HC A05/MF A01

An explanation how to enter, run, and debug programs on the Octopus network is presented. The network's operation is briefly described. Service programs that are most useful in the long run are stressed. The Octopus timesharing network gives the user access to four CDC 7600 computers, two CDC STAR computers, and a broad array of peripheral equipment, from any of 800 or so remote terminals. ERA

N77-26869# California Univ., Livermore. Lawrence Livermore Lab.
DISTRIBUTED CAPABILITY COMPUTING SYSTEM
J. E. Donnelley 15 Apr. 1976 10 p refs Presented at the 3d Intern. Conf. on Computer Commun., Toronto, 3 Aug. 1976
(Contract W-7405-eng-48)
(UCRL-77800; Conf-760873) Avail: NTIS HC A02/MF A01

One component of the resource sharing problem, that of designing protocols and mechanisms to access standardized resources, is solved. The first step in the solution is the definition of a standardized computer resource based on a set of interprocess communication primitives that are introduced. Building upon these primitives, a mechanism for sharing the standardized resources that is independent of the resource types is presented. Applications are included which provide transparent network resource optimization and an automated money exchange. ERA

N77-26870# California Univ., Livermore. Lawrence Livermore Lab.
CONTROLLING TRANSACTIONS BETWEEN DISTRIBUTED COMPUTER RESOURCES
J. E. Donnelley 4 Jun. 1977 9 p refs Presented at 5th Conf. on Computing Systems, Austin, Tex., 18 Oct. 1976
(Contract W-7405-eng-48)
(UCRL-78282-Rev-1) Avail: NTIS HC A02/MF A01

A protoype transaction controller system to provide analysts with direct access to distributed computer resources by making external resources internally available in a unified manner is described. The transaction controller differs from other systems with similar objectives in that its capability list operating system kernel supports an extendable set of uniformly processed internal objects and an enforced separation of internal responsibility which can be extended readily to distributed resources. The type independent resource sharing mechanism built upon these facilities allows most of the transaction controller software to concentrate on the difficult task of translating external resources which are physically different but semantically similar into identical internal resources. ERA

N77-26871# Brown Univ., Providence, R. I.
NETWORK PATTERN PROCESSORS
Ulf Grenander Dec. 1976 37 p
(Contract N00014-75-C-0461)
(AD-A037129) Avail: NTIS HC A03/MF A01 CSCL 05/7

This report on pattern processors for language abduction is chapter seven of a book to be published on pattern analysis. GRA

N77-26872# Naval Electronics Lab. Center, San Diego, Calif.
COMMAND CENTER INFORMATION SYSTEM (CCIS) FUNCTIONS AND CAPABILITIES Research and Development Report, Mar. 1974 - Nov. 1976
D. L. Small and D. O. Christy 10 Nov. 1976 18 p refs
(XF21211001; XF21211002)
(AD-A037146; NELC-TD-498) Avail: NTIS HC A02/MF A01 CSCL 05/2

This document details the Command Center Information System (DDIS), a new architectural concept for Navy Information Storage and Retrieval (ISAR). The system consists of a query (user) processor, connected to a data processor by a 1200-band communication line, a buffer memory, an interface processor, and bulk storage. GRA

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N77-26873# Oxford Univ. (England). Dept. of Engineering Science.
OPTIMAL CONTROL OF A STOCHASTIC BILINEAR SYSTEM
O. L. R. Jacobs and R. V. Potter Jun. 1976 19 p refs Presented at IMA Conf. on Recent Theoret. Develop. in Control, Leicester, Engl., 14-16 Sep. 1976
(OUEL-1156/76) Avail: NTIS HC A02/MF A01

Optimal control of a discrete-time, scalar, stochastic, bilinear system is discussed. Dynamic programing analysis leads to equations which specify the optimal control but which cannot be solved in closed form. The equations were solved numerically, and some typical results are presented. The system was simulated under the numerically computed optimal control, and the observed cost agreed well with the value predicted by the computations. Other control, such as the certainty-equivalent control and the one-step-ahead control, were simulated and found to give larger values of cost. Features of the optimal control for the bilinear system are discussed in relation to features such as neutrality, caution, probing, and turn-off, which have been observed in these other nonlinear problems. Author (ESA)

N77-26874# University of Southern Calif., Marina del Rey. Information Sciences Inst.
AN ASSESSMENT OF RELIABILITY OF DIALOGUE ANNOTATION INSTRUCTIONS
William C. Mann, James H. Carlisle, James A. Moore, and James A. Levin Jan. 1977 66 p refs
(Contract N00014-75-C-0710; ARPA Order 2930; NR Proj. 154-374; RR0420601)
(AD-A037109; ISI/RR-77-54) Avail: NTIS HC A04/MF A01 CSCL 05/8

This report is part of an ongoing research effort on man-machine communication, which is engaged in transforming knowledge of how human communication works into improvements in man-machine communication of existing and planned computer systems. This research has developed some methods for finding certain kinds of recurring features in transcripts of

human communication. These methods involve having a trained person, called an Observer, annotate the transcript in a prescribed way. One of the issues in evaluating this methodology is the potential reliability of the Observer's work. This report describes a test of Observer reliability. It was necessary to design a special kind of test, including some novel scoring methods. The test was performed using the developers of the instructions as Observers. The test showed that very high Observer reliability could be achieved. This indicates that the observation methods are capable of deriving information which reflects widely shared perceptions about communication, and which is therefore the right kind of data for developing human communication theory. It is a confirmation of the appropriateness and potential effectiveness of using this kind of observations in the dialogue-modeling methodology of which they are a part. It is also of particular interest as an approach to study of human communication based on text, since content-related text-annotation methods have a reputation of low reliability. GRA

N77-26875# Brown Univ., Providence, R. I.
APPLICATIONS OF PATTERN THEORY TO PROBLEMS IN COMPUTER SCIENCE
Oct. 1976 48 p refs
(Contract N00014-75-C-0461)
(AD-A037128) Avail: NTIS HC A03/MF A01 CSCL 05/7

Pattern theory is concerned with the study of regularity of objects in particular domains of discourse. Each domain of discourse has its own characteristic kinds of objects. However, it is convenient to develop a domain-independent framework which provides a starting point for the study of regularity in particular of discourse. GRA

N77-26876# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
OVERVIEW OF A LINGUISTIC THEORY OF DESIGN
Mark L. Miller and Ira P. Goldstein Feb. 1977 32 p refs
(Contracts N00014-75-C-0643; MDA903-76-C-0108)
(AD-A036977; AI-M-383A; Logo-M-30A) Avail: NTIS HC A03/MF A01 CSCL 05/7

The SPADE theory uses linguistic formalisms to model the program planning and debugging processes. The theory has been applied to constructing a grammar-based editor in which programs are written in a structured fashion, designing an automatic programming system based on an Augmented Transition Network, and parsing protocols of programming episodes. GRA

N77-26877# Defense Systems Management School, Fort Belvoir, Va.
CYBERNETICS: AN OVERVIEW
Guy G. Zimmerman Nov. 1976 38 p refs
(AD-A037993) Avail: NTIS HC A03/MF A01 CSCL 06/4

A systematic review of the literature was conducted through the facilities of the DSMC library to find literature dealing with the subject. Cybernetics is defined and the development of the subject from conception to fledging science is advanced. The higher system to which it belongs is proposed along with several methods for studying those systems. The language of cybernetics is discussed and selected terms are defined. A simple working model is presented. Various partitions of the pure and applied cybernetics are shown. Finally, three topics for future study are proposed because of the apparent value cybernetics has in studying the relationships between systems. GRA

N77-26878# Southeastern Massachusetts Univ., North Dartmouth. Dept. of Electrical Engineering.
REPORT OF THE 1976 JOINT WORKSHOP ON PATTERN RECOGNITION AND ARTIFICIAL INTELLIGENCE Interim Report
C. H. Chen 21 Dec. 1976 20 p refs Workshop held at Hyannis, Mass., 1-3 Jun. 1976
(Grant AF-AFOSR-2951-76)
(AD-A037503; EE-76-7; AFOSR-TR-77-0124) Avail: NTIS HC A02/MF A01 CSCL 06/4

This is the final report of the technical program of the workshop held June 1-3, 1976, at Hyannis, Mass. Papers presented at the meeting are carefully reviewed by topics: scene analysis and image processing, syntactic and statistical pattern recognition, relational data structure and data base management, language understanding and speech recognition, biomedicine, production systems and knowledge-based systems, computer graphics, game-playing programs and distortion modeling. Panel discussions sessions are examined. Recommendation and assessment for future developments in both pattern recognition and artificial intelligence are also presented. Author (GRA)

N77-26879# Tennessee Univ., Knoxville. Dept. of Electrical Engineering.
FEATURE EXTRACTION AND RECOGNITION OF TWO-DIMENSIONAL DATA BY THE METHOD OF MOMENTS Technical Report, 1 Oct. 1975 - 1 Oct. 1976
R. C. Gonzalez and J. M. Harris 15 Jan. 1977 104 p refs
(Contract N00014-75-C-0545; NR Proj. 215-228)
(AD-A037445; ONR-CR215-228-2) Avail: NTIS HC A06/MF A01 CSCL 17/9

A pattern recognition system applicable to two dimensional data is presented, and training algorithms for generating pattern classifiers are surveyed. The method of moments is used by the system as a feature extractor. The Mahalanobis distance measure is presented as a criterion for the selection of moment pairs to be used as descriptors. Experiments conducted using simulated high resolution radar images demonstrate the effectiveness of the system using unstructured data. Classification results for the system are compared to those of human interpreters.
Author (GRA)

N77-26880# Ohio State Univ., Columbus. Dept. of Electrical Engineering.
AUTOMATIC PATTERN RECOGNITION IN A MULTI-SENSOR ENVIRONMENT Final Report, 1 Jan. - 31 Dec. 1976
Kenneth J. Breeding 25 Feb. 1977 20 p
(Grant AF-AFOSR-2953-76; AF Proj. 9769)
(AD-A037968; AFOSR-77-0216TR) Avail: NTIS HC A02/MF A01 CSCL 09/4

During this period a number of investigations were undertaken directed at the general goals of improving the accuracy, reliability and speed of visual recognition systems. Work was carried out on basically three different problems. The development of a multiple look sequential recognition system to improve accuracy and reliability, the development of an image array processor for application to real time image identification, and the analysis of various features and authority file generation algorithms to identify properties which may reduce the training period. In addition, an investigation was also carried out on the application of 'fuzzy' automata to the scene segmentation problem. Finally, an application of the work carried out here was developed in the use of visual feedback for work piece positioning and control. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N77-26881 Materials Research Labs., Melbourne (Australia).
SPECTRAL CHARACTERISTICS OF A FLICKER NOISE MODEL
G. K. Manzie and C. I. Sach Jan. 1977 26 p refs
(MRL-R-680; AR-000-291) Copyright. Avail: Issuing Activity

An equation is developed to generate discrete values of flicker, or f/1 noise, for use in mathematical modelling. Spectral analyses of the simulated noise produced by this equation show that the spectral power response varies with the number of samples used in the calculation. Author

N77-26882# Washington Univ., Seattle. Dept. of Mathematics.
INTEGRAL FUNCTIONALS, NORMAL INTEGRANDS AND MEASURABLE SELECTIONS Interim Report
R. Tyrrell Rockafellar 1977 53 p refs
(Grant AF-AFOSR-2269-72)
(AD-A037561; AFOSR-77-0190TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

A fundamental notion in many areas of mathematics, including

optimal control, stochastic programming, and the study of partial differential equations, is that of an integral functional. By this is meant an expression of the form where a linear space of measurable functions is defined on a measure space having values in a linear space. This paper provides a thorough treatment of the properties of such functionals, including properties of continuity, convexity, and duality. GRA

N77-26883# General Dynamics/Pomona, Calif. Pomona Div.
CUBIC SPLINES IN CLUTTER MODELING
18 Nov. 1976 5 p
(Contract N00017-73-C-2244)
(AD-A036975; M-2B-TAGSEA-023) Avail: NTIS HC A02/MF A01 CSCL 09/4

In developing clutter models, Raytheon used smoothing cubic splines to obtain analytical expression for the clutter amplitude distribution functions. This application is believed to be unique. This report has been prepared to describe in detail the development of the smoothing cubic spline. An explanation of the large oscillations in the error obtained in the fit or data match for large clutter values is given, and a method that would avoid the oscillations is discussed. GRA

N77-26884# Oak Ridge National Lab., Tenn.
KWIC INDEX FOR NUMERICAL ALGEBRA, SUPPLEMENT 1
John A. Carpenter Dec. 1976 136 p Revised
(Contract W-7405-eng-26)
(ORNL/CSD-18-(Suppl-1); ORNL-4778-Rev) Avail: NTIS HC A07/MF A01

This listing is a supplement to Professor A. S. Householder's KWIC Index for Numerical Algebra, ORNL-4778, Revised June 1975. Corrections and additional review journal citations for ORNL-4778, revised, are not included in this supplement, which lists 1,325 new entries of interest to those working in this branch of numerical analysis. ERA

N77-26885# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
AN IMPLICIT, COMPACT, FINITE DIFFERENCE METHOD TO SOLVE HYPERBOLIC EQUATIONS
H. J. Wirz, F. DeSchutter, and A. Turi Jul. 1976 49 p refs (VKI-TN-119) Avail: NTIS HC A03/MF A01

A totally implicit, compact high order finite difference method to treat systems of partial differential equations in a semi-bounded domain was developed, analyzed and successfully tested for the linear wave equations and the time dependent Euler equations describing the motion of an inviscid fluid. An implicit method of high order accuracy which is unconditionally stable, thus making it possible to progress much faster in time, was developed and analyzed. Furthermore, the presence of additional artificial boundary conditions does have an influence on the accuracy of the solution but not on the stability of the method. The numerical scheme was checked using two examples: the solution of the (linear) wave equation and the nonlinear Euler equations of fluid dynamics. Author (ESA)

N77-26886# Army Research Office, Research Triangle Park, N. C.
TRANSACTIONS OF THE 22ND CONFERENCE OF ARMY MATHEMATICIANS Interim Technical Report
Feb. 1977 607 p refs Conf. held at Watervliet, N. Y., 12-14 May 1976
(AD-A037211; ARO-77-1) Avail: NTIS HC A99/MF A01 CSCL 12/1

This is a technical report resulting from the Twenty-second Conference of Army Mathematicians. It contains most of the papers on the agenda of this meeting. These treat various Army applied mathematical problems. Author (GRA)

N77-26887# California Univ., Los Angeles. Dept. of System Science.
LIKELIHOOD RATIOS FOR TIME-CONTINUOUS DATA MODELS: THE WHITE NOISE APPROACH Interim Report
A. V. Balakrishnan Dec. 1976 12 p refs Presented at IRIA Intern. Symp. on New Trends in Systems Analysis, Versailles, France, Dec. 1975
(Grant AF-AFOSR-2492-73)
(AD-A037764; AFOSR-77-0173TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This document develops a formula for likelihood functionals for signals in additive noise in the time-continuous case using a white noise approach. It is shown that the formula differs from the well-known formula in the Wiener process version by the appearance of an additional term corresponding to the conditional mean square filtering error. GRA

N77-26888# Colorado State Univ., Fort Collins. Dept. of Mathematics.
BEST RATIONAL APPROXIMATIONS WITH NEGATIVE POLES TO e TO THE -x POWER ON (0, INFINITY) Interim Report
E. H. Kaufman, Jr. and G. D. Taylor Dec. 1976 15 p refs
(Grant AF-AFOSR-2878-76)
(AD-A037559; AFOSR-77-0166TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this paper a theory for approximating e(-x) on (O, infinity) with rational functions having negative poles is developed. Numerical results suggest that the best uniform approximation to e(-x) on (O, infinity) from this class has only one pole and this is shown to be the case when using rational functions of this form which are linear polynomials divided by quadratic polynomials. Numerical results are given and compared to recent results of Saff, Schonhage and Varga. GRA

N77-26889# Delaware Univ., Newark. Dept. of Mathematics.
CONSTRUCTIVE FUNCTION THEORETIC METHODS FOR HIGHER ORDER PSEUDOPARABOLIC EQUATIONS Interim Report
Robert P. Gilbert and G. C. Hsiao 1976 21 p refs
(Grant AF-AFOSR-2879-76)
(AD-A037671; AFOSR-77-0189TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this paper the approach to higher order, elliptic partial differential equations in the plane is extended to the cases of meta and pseudoparabolic equations. The method makes use of a generalization of the Riemann function associated with the complex hyperbolic equation obtained by analytic continuation. A fundamental solution is obtained whose Taylor (Laurent) expansion in powers of the time has as its first term the classical fundamental solution of Vekua. Integral representations are obtained for the initial boundary value problems. GRA

N77-26890# George Washington Univ., Washington, D.C. Inst. for Management Science and Engineering.
STRATEGIES FOR THE MINIMIZATION OF AN UNCONSTRAINED NONCONVEX FUNCTION Interim Report
Garth P. McCormick 1 Nov. 1976 25 p refs
(Grant AF-AFOSR-2504-73)
(AD-A037820; Serial-T-343; AFOSR-77-0171TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Several strategies are discussed which modify the classical form of Newton's method for minimizing an unconstrained function of several variables when at some point the Hessian matrix is not positive definite. A simple example is solved to explain the different methods. Author (GRA)

N77-26891# Maryland Univ., College Park. Computer Science Center.
OPTIMAL PREFILTERING FOR SPLINE RECONSTRUCTION Interim Report
Robert Hummel (Minn. Univ., Minneapolis) Jan. 1977 19 p refs
(Contract F44620-72-C-0062)
(AD-A037504; TR-502; AFOSR-77-0125TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The use of an optimal prefilter prior to sampling can lead to reduced mean square error after reconstruction. The form of the best prefilter or the associated local weighting function depends upon the reconstruction method to be used. These weighting functions are discussed for the most common spline reconstruction methods. GRA

N77-26892# Michigan Univ., Ann Arbor. Systems Engineering Lab.

VECTORIZED GENERAL SPARSITY ALGORITHMS WITH BACKING STORE Interim Report
D. A. Calahan, P. G. Buning, and W. N. Joy 15 Jan. 1977 118 p refs
(Grant AF-AFOSR-2812-75)
(AD-A037971; SEL-96; AFOSR-77-0259TR) Avail: NTIS HC A06/MF A01 CSCL 12/1

The direct solution of large, sparse unsymmetric sets of simultaneous equations is commonly involved in the numerical solution of algebraic, differential, and partial differential equations. This report describes two new classes of computational algorithms for the solution of such equations. Each algorithm detects matrix structure suitable for vector processing and, potentially, for faster processing on cache machines. One procedure favors structure usually associated with small sparse matrices; one is directed toward sets of equations requiring a large backing store. Comparisons of timing (on a cache machine) and of memory requirements are made between these new procedures and existing general sparsity techniques for a variety of science-engineering examples. Issues related to implementation are given for software implementations of the two algorithms. GRA

N77-26893# Naval Undersea Center, San Diego, Calif.
TIME EVOLVING SPECTRA Technical Report, Sep. 1974 - Sep. 1975
O. D. Grace Apr. 1976 51 p refs
(AD-A037151; NUC-TP-509) Avail: NTIS HC A04/MF A01 CSCL 12/1

Conventional spectral analysis methods do not describe the distribution of signal power in both time and frequency. Time dependent Fourier transforms are defined to extend the conventional theory to include instantaneous energy and power spectra for the past and future signal. These spectra are combined to define a generalized instantaneous power spectrum (GIPS) of the entire signal. The Sliding FFT method of calculating the GIPS is examined and the equivalence between the estimates for the real and analytic signal is shown. These methods are applied to nonstationary stochastic processes and the GIPS is shown as given by the Fourier transform of Loeve's generalized power spectrum of the process and to be the generalization of the Wiener-Kintchine theorem to nonstationary processes. It is also shown to represent the stationary process, the locally stationary process, and the deterministic process. In addition to the GIPS, i.e., the spectral mean, an expression for the spectral covariance, is given and the relationship between these functions and a GIPS estimate via an ensemble of Sliding FFT calculations is examined. Author (GRA)

N77-26894# Syracuse Univ., N. Y. Dept. of Industrial Engineering and Operations Research.
THINNING OF A POINT PROCESS OVER TIME Interim Report
Richard F. Serfozo 1976 22 p refs
(Grants AF-AFOSR-2627-74; NSF ENG-75-13653)
(AD-A037491; AFOSR-77-0122TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Thinning of a point process refers to the procedure in which points are randomly placed in a region and then they are deleted according to some rule. The aim is to answer questions such as (1) how can the random placement and detection of points be described mathematically; (2) what types of thinned processes arise from various thinning rules; (3) how much thinning is needed for a desired rarefaction of points; and (4) when does one reach diminishing returns in thinning. Examples of thinning procedures are debugging of computer programs and complex systems, filtration of particles from a solution, and the elimination of undesirable cell growth, insects or plants. This paper addresses several thinnings in which points are deleted over time. We show how the asymptotic behavior of a thinned process is equivalent to that of extreme values of the lives of its points under the thinning. We use this to describe independent, regenerative, and semi-stationary thinnings. GRA

N77-26895# Virginia Univ., Charlottesville. Dept. of Applied Mathematics and Computer Science.
MATHEMATICAL INVESTIGATIONS OF DYNAMICAL SYSTEMS Final Report
D. L. Lukes Sep. 1976 11 p refs
(Contract N00014-76-C-0073)
(AD-A036771; UVA/525318/AMCS76/101) Avail: NTIS HC A02/MF A01 CSCL 12/1

This final report summarizes the work accomplished within the Department of Applied Mathematics and Computer Science at the University of Virginia through support of the United States Office of Naval Research under Contract No. N00014-76-C-0073 which expired July 31, 1976. GRA

N77-26896# Naval Postgraduate School, Monterey, Calif.
ASYMPTOTIC REPRESENTATION OF STIRLING NUMBERS OF THE SECOND KIND
W. E. Bleick and Peter C. C. Wang 9 Feb. 1977 13 p refs
(AD-A035713; NPS-53BL77021) Avail: NTIS HC A02/MF A01 CSCL 12/1

The distribution of the Stirling numbers S(n,k) of the second kind with respect to K was shown to be asymptotically normal near the mode. A new single-term asymptotic representation of S(n,k), more effective for large k, is given here. It is based on Hermite's formula for a divided difference and the use of sectional areas normal to the body diagonal of a unit hypercube in k-space. A proof is given that the distribution of these areas is asymptotically normal. A numerical comparison is made with the Harper representation for n=200. Author

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N77-26897*# Joint Inst. for Advancement of Flight Sciences, Hampton, Va.
A MATHEMATICAL STUDY OF A RANDOM PROCESS PROPOSED AS AN ATMOSPHERIC TURBULENCE MODEL
Kenneth Sidwell May 1977 46 p refs
(Grant NGR-09-010-078)
(NASA-CR-145200) Avail: NTIS HC A03/MF A01 CSCL 12A

A random process is formed by the product of a local Gaussian process and a random amplitude process, and the sum of that product with an independent mean value process. The mathematical properties of the resulting process are developed, including the first and second order properties and the characteristic function of general order. An approximate method for the analysis of the response of linear dynamic systems to the process is developed. The transition properties of the process are also examined. Author

N77-26898# Army Armor and Engineer Board, Fort Knox, Ky.
TABLES OF REQUIRED SAMPLE SIZE FOR PAIRWISE COMPARISONS. Final Report
Henry I. Jehan, Jr. 7 Feb. 1977 46 p
(AD-A035603; TM-2-77) Avail: NTIS HC A03/MF A01 CSCL 12/1

This memorandum consists of tables of sample sizes required to make pairwise comparisons between populations at specified levels of confidence and descrimination. They assume normally distributed data at a predictable probability of occurrence.
Author (GRA)

N77-26899# North Carolina Univ., Chapel Hill. Dept. of Statistics.
A MONTE-CARLO STUDY OF ROBUST ESTIMATORS OF LOCATION Interim Report
Edward J. Wegman and R. J. Carroll 1976 22 p refs
(Grant AF-AFOSR-2840-75)
(AD-A035739; AFOSR-77-0022TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Andrews et al (1972) carried out an extensive Monte Carlo study of robust estimators of location. Their conclusions were that the hampel and the skipped estimates, as classes, seemed to be preferable to some of the other currently fashionable estimators. The present study extends this work to include estimators not previously examined. The estimators are compared over short-tailed as well as long-tailed alternatives and also over

some dependent data generated by first-order autoregressive schemes. The conclusions of the present study are threefold. First, from our limited study, none of the so-called robust estimators are very robust over short-tailed situations. More work seems to be necessary in this situation. Second, none of the estimators perform very well in dependent data situations, particulary when the correlation is large and positive. This seems to be a rather pressing problem. Finally, for long-tailed alternatives, the hampel estimators and Hogg-type adaptive versions of the hampels are the strongest classes. GRA

N77-26900# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Structural Mechanics Div.
STATISTICAL MEASURES, PROBABILITY DENSITIES, AND MATHEMATICAL MODELS FOR STOCHASTIC MEASUREMENTS Final Report, Nov. 1973 - Jul. 1976
Robert G. Merkle Oct. 1976 121 p refs
(AF Proj. 1472)
(AD-A037483; AFFDL-TR-76-83) Avail: NTIS HC A06/MF A01 CSCL 12/1

Statistical measures, probability densities, and mathematical modeling techniques useful in the analysis of stochastic measurements are summarized. Univariate measures are given for average, dispersion, skewness, and kurtosis. Probability Densities include: Normal, Student t, Cauchy, Gamma, Exponential, Chi-square, F, Rayleigh, Maxwell, Log-normal, Beta, Uniform, and Arc-sine. Measures of interdependence between two variables include simple correlation, autocorrelation, cross-correlation, rank correlation, point biserial correlation, tetrachoric correlation, and coefficients of contingency. Measures of interdependence among several variables include multiple correlation, marginal correlation, conditional correlation, canonical correlation, and auto and cross-correlation for ensembles of measurements. Mathematical modeling techniques include factor analysis and both regression and analysis of variance formulated as the general linear hypothesis model. Author (GRA)

N77-26901# California Univ., Riverside.
COVARIANCE ANALYSIS OF SOME NONSTATIONARY TIME SERIES Final Technical Report, 1 Aug. 1974 - 1 Aug. 1976
M. M. Rao Dec. 1976 50 p refs
(Contract F33615-74-C-4009; AF Proj. 7071)
(AD-A037482; AFFDL-TR-76-128) Avail: NTIS HC A03/MF A01 CSCL 12/1

Some classes of nonstationary time series, of both continuous and discrete parameter, have been analyzed essentially based on their correlation structure. These classes include the important family, isolated by Kampe' de Feriet and Frenkiel and independently by Parzen, and some unstable series. The behavior of the trajectories has been studied in all these cases, which consider the difference schemes as well as the differential equation systems. Both the potential applications and new problems arising from this analysis have been pointed out throughout. GRA

N77-26902# Stanford Univ., Calif. Dept. of Electrical Engineering.
LEVINSON- AND CHANDRASEKHAR-TYPE EQUATIONS FOR A GENERAL, DISCRETE-TIME LINEAR ESTIMATION PROBLEM
B. Friedlander, M. Morf, T. Kailath, and L. Ljung Dec. 1976 13 p refs
(Contract F44620-74-C-0068; Grant NSF ENG-75-18952)
(AD-A037678; AFOSR-77-0284TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Recursive algorithms for the solution of linear least-squares estimation problems have been based mainly on state-space models. It has been known, however, that such algorithms exist for stationary time-series, using input-output descriptions (e.g., covariance matrices). We introduce a way of classifying stochastic processes in terms of their 'distance' from stationarity that leads to a derivation of an efficient Levinson-type algorithm for arbitrary (nonstationary) processes. By adding structure to the covariance matrix, these general results specialize to state-space type estimation algorithms. In particular, the Chandrasekhar equations are shown to be the natural descendants of the Levinson algorithm. Author (GRA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N77-26903 British Library Lending Div., Boston Spa (England).
ESTABLISHMENT OF LINEAR SEQUENCES
K. Okamara and H. Yamashina Jan. 1977 29 p Transl. into ENGLISH from Seimitsu Kikai (Japan), v. 35, no. 8, 1969 p 25-32
(BLL-RTS-10323) Avail: British Library Lending Div., Boston Spa, Engl.

Sequencing problems in mechanical engineering where high productivity is desirable are described. Main features of such problems are given and various methods in relation to linear sequences are listed as the following: (1) box method; (2) fixing method; (3) reverse arrow method; and (4) grouping method. Author

N77-26904# European Space Agency, Paris (France).
COMPUTER-AIDED ANALYSIS OF CIRCUITS AND SYSTEMS
Mar. 1977 250 p refs Partly in FRENCH and partly in ENGLISH Proc. of Conf. held at ESTEC, Noordwijk, Neth., 24 Jan. 1977 (ESA-SP-123) Avail: NTIS HC A11/MF A01

Contribution to an internal ESTEC workshop on the use of computer-aided analysis in design studies, are presented. Topics covered include description of programs for nonlinear circuit analysis (IMAG-III), linear microwave circuit analysis (ESAMEC), logic circuit simulation (ESTEC), discrete event simulation (SIMULA), communications system simulation (MODSIM), transfer function analysis (FTANAL), and graphic input of circuits (CDSLG). These programs are all operational on ESTEC'c computers. For individual titles, see N77-26905 through N77-26912.

N77-26905# European Space Research and Technology Center, Noordwijk (Netherlands). Systems Simulation Section.
OVERALL VIEW OF COMPUTER-AIDED ANALYSIS AT ESTEC [VUE D'ENSEMBLE SUR L'ANALYSE AIDEE PAR ORDINATEUR A L'ESTEC]
M. Guerin *In* ESA Computer-aided Anal. of Circuits and Systems Mar. 1977 p 1-5 In FRENCH (For primary document see N77-26904 17-66)
HC A11/MF A01

A general description of programs operational at ESTEC, for circuit analysis purposes, is presented. The IMAG III language was acquired for simulatiom of nonlinear electric circuits. A special program, ESAMEC, was developed for microwave circuits. The ESTEC program permits the analysis of logic circuits and the examination of effects of faults. A program for the analysis of transfer functions, FTANAL, was developed for the study of control systems. A general diagram is given to describe the organization of each of these programs. ESA

N77-26906# European Space Research and Technology Center, Noordwijk (Netherlands). Systems Simulation Section.
IMAG-3: NON-LINEAR CIRCUIT ANALYSIS
M. Guerin *In* ESA Computer-aided Anal. of Circuits and Systems Mar. 1977 p 6-21 (For primary document see N77-26904 17-66)
HC A11/MF A01

The IMAG-3 is a program for simulation of electronic circuits at component level (resistors, capacitors, transistors, etc.). The rationale of selecting that particular language is discussed, and its main features are presented: input description languages, types of analysis performed, and library of component models. Some details of the implementation in ESTEC are discussed, including the present effort on the modeling of frequently used components. Some examples of recent work are presented. Author (ESA)

N77-26907# European Space Research and Technology Center, Noordwijk (Netherlands). Systems Simulation Section.
ESAMEC: COMPUTER-AIDED ANALYSIS OF MICROWAVE ELECTRONIC CIRCUITS IN THE FREQUENCY DOMAIN
J. G. Ferrante, J. K. Nielsen, and A. S. Montenegro *In* ESA Computer-aided Anal. of Circuits and Systems Mar. 1977

p 22-68 refs (For primary document see N77-26904 17-66)
Avail: NTIS HC A11/MF A01

An ESA-developed general-purpose computer program for the frequency domain analysis of microwave electronic circuits, ESAMEC, is based on transfer matrices techniques. It handles a large variety of lumped and distributed elements such as transmission lines, stubs, circulators, hybrids, and couplers, as well as active devices described by thair measured characteristics. It is structured for use by personnel with no knowledge of programming and can analyze virtually any type of microwave design in TEM mode. Author (ESA)

N77-26908# European Space Research and Technology Center, Noordwijk (Netherlands). Systems Simulation Section.
ESTEL: A COMPUTER PROGRAM FOR SIMULATION OF LOGIC CIRCUITS
E. Kristiansen *In* ESA Computer-aided Anal. of Circuits and Systems Mar. 1977 p 69-83 (For primary document see N77-26904 17-66)
Avail: NTIS HC A11/MF A01

The purpose of ESTEL, a computer program for the simulation of logic circuits, is to efficiently simulate the behavior of digital logic without having to solve the differential equations which an RLC level description would lead to. The main features of this program are the use of five logical states, the simulation of propagation delays, the application of parallel simulation techniques for the simulation of faults, and the availability of a library of frequently used components. Author (ESA)

N77-26909# European Space Research and Technology Center, Noordwijk (Netherlands). Systems Simulation Section.
SIMULA: A HIGH-LEVEL GENERAL-PURPOSE DISCRETE EVENTS SIMULATION
C. Garrido *In* ESA Computer-aided Anal. of Circuits and Systems Mar. 1977 p 85-166 (For primary document see N77-26904 17-66)
Avail: NTIS

SIMULA 67 is a high-level language which can be used to solve problems for a wide range of applications, such as scientific computations, text handling, and discrete-events simulation in an efficient and elegant way. The main features and capabilities of the language are demonstrated. Three typical applications are presented concerning an object manipulation problem, queuing system simulation, and a shore-station-to-shore-station procedure evaluation used for the MAROTS system. Author (ESA)

N77-26910# European Space Research and Technology Center, Noordwijk (Netherlands). Analysis and Programming Section.
MODSIM: ITS APPLICATION TO TELECOMMUNICATIONS
A. Long and J. C. Debruyn *In* ESA Computer-aided Anal. of Circuits and Systems Mar. 1977 p 167-194 refs (For primary document see N77-26904 17-66)
HC A11/MF A01

MODSIM is a language for simulating modulated communication channels, in particular, satellite transponders, on a digital computer. The background and general structure of the MODSIM system available on the ESTEC ICL 4/72 are given, together with a description of the commands available to the user. The use of the Fast Fourier Transform and the representation of signals and common circuit devices (e.g. modulators, demodulators, filters) are outlined. The simulation of a matched filter receiver for a Gaussian noise modulated transmission is given as a space program. Author (ESA)

N77-26911# European Space Research and Technology Center, Noordwijk (Netherlands). Systems Simulation Section.
FTANAL: COMPUTER-AIDED ANALYSIS OF CONTINUOUS AND SAMPLED LINEAR CONTROL SYSTEMS
J. G. Ferrante *In* ESA Computer-aided Anal. of Circuits and Systems Mar. 1977 p 195-225 refs (For primary document see N77-26904 17-66)
Avail: NTIS HC A11/MF A01

An interactive program, FTANAL performs calculations for monovariable continuous or sampled control system designs described by means of the familiar transfer function block-diagram representation. In a matter of seconds transient and frequency responses, as well as root locus diagrams, are readily available on a graphical storage tube display with hard-copy unit attached. Although the program was originally developed for quick evaluation of PWM controlled regulators, it can also be used for any type of control loops arising in various branches of engineering. Author (ESA)

N77-26912# European Space Research and Technology Center, Noordwijk (Netherlands). Systems Simulation Section.
CDSLG: AN INTERACTIVE PROGRAM FOR THE DESCRIPTION OF CIRCUITS
J. J. Mathieu *In* ESA Computer-aided Anal. of Circuits and Systems Mar. 1977 p 227-245 (For primary document see N77-26904 17-66)
Avail: NTIS HC A11/MF A01

The Circuit Drawing and Source Language Generator (CDSLG) described is an interactive program for the graphic description of circuits. Its aim is to translate users' drawings into commands that could be used by a software simulator. The drawings are made by the user on a digitizing tablet and are echoed on a screen while the commands are stored on a mass-storage device. Once the drawing is completed, it can be copied on a hard-copy device (digital plotter), and the command file can be edited and transmitted to the appropriate simulation program. Author (ESA)

N77-26913# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
INFORMATION, CONSISTENT ESTIMATION AND DYNAMIC SYSTEM IDENTIFICATION Interim Report
Yoram Baram Nov. 1976 146 p refs
(Grant AF-AFOSR-2273-72; AF Proj. 2304)
(AD-A037972; ESL-R-718; AFOSR-77-0283TR) Avail: NTIS HC A07/MF A01 CSCL 09/4

The asymptotic behavior of parameter estimates and the identification and modeling of dynamical systems are investigated. Measures of the relevant information in a given sequence of observations are defined and shown to possess useful properties, such as the metric property on the parameter set. The convergence of maximum likelihood and related Bayesian estimates for general observation sequences is investigated. The situation where the true parameter is not a member of a given parameter set is considered as well as the situation where the parameter set includes the true' model. The finite parameter set case is emphasized for simplicity in the convergence analysis, but the results are extended in general terms to the infinite parameter case. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N77-26914# Maryland Univ. Baltimore County, Baltimore. Div. of Mathematics and Physics.
EXPONENTIAL FOURIER DENSITIES ON A RIEMANNIAN METRIC AND OPTIMAL ESTIMATION FOR AXIAL PROCESSES Interim Report
James Ting-Ho Lo and Linda R. Eshleman Jan. 1977 27 p refs
(Grant AF-AFOSR-2671-74)
(AD-A037505; MRR-77-1; AFOSR-77-0126TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

Several models, which are believed to be generic for the estimation of discrete-time axial processes, are proposed. By introducing axial exponential Fourier densities and axial exponential trigonometric densities, finite-dimensional recursive schemes are obtained for updating the conditional density functions. The underlying idea is the closure properties under the Bayes rule of the various combinations of these exponential densities. An estimation error criterion, which is compatible with a Riemannian metric, is introduced. It is shown that the corresponding optimal axial estimates can be easily computed. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N77-26915 British Library Lending Div., Boston Spa (England).
CONCERNING THE EXISTENCE OF TWO FERRORESONANCE REGIMES
F. Margand [1976] 8 p Transl. into ENGLISH from Rev. Gen. Elec. (France), v. 9, no. 19, May 1971 p 635-637
(BLL-CE-Trans-6837-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

Experimental results show two different regimes of current in an ac circuit. A very simple geometrical theory described, gives three theoretical operating points. To make it agree with practice, it is therefore necessary to assume that one of these points, although theoretically possible, must correspond to an unstable regime and should be rejected. An attempt is made to show that the point corresponding to the minimum current can be rejected. Author

N77-26916# Energy Research and Development Administration, Washington, D.C.
ENERGY AND PHYSICS
P. L. Kapitsa 1976 12 p refs Transl. into ENGLISH from Usp. Fiz. Nauk (USSR), v. 118, no. 2, 1976 p 307-314
(ERDA-TR-225) Avail: NTIS HC A02/MF A01

Hydrogen fuel cells are very efficient, but the extremely small rate of diffusion in electrolytes renders the energy density very small: for 100 MW of power the working area of electrodes reaches a square kilometer. Similar comments apply to direct conversion of solar energy into electricity. Solar power does not exceed 100 W/sq m, hence, to generate 100 MW one must take electricity from an area of one square kilometer, and not one of the methods of converting solar energy suggested so far can realize this such that capital expenditures can be justified. Costs must be reduced by several orders of magnitude; at least at present, the practical direct use of solar energy is unrealistic on a large scale. Use of geothermal energy requires very great areas at a depth of 10 to 15 km; the difficulties are such that the possibility of heating the required amount of water is in doubt. Damming rivers, except in mountains, and use of wind are also economically unjustified. Evidently nuclear energy is the only solution. ERA

N77-26917# Institut Franco-Allemand de Recherches, St. Louis (France).
PROGRAM FOR TRAJECTORY CALCULATION OF PENDULATING PROJECTILES [EIN PROGRAMM ZUR BERECHNUNG DER FLUGBAHN VON PENDELNDEN GESCHOSSEN]
V. Fleck and H. Molitz 26 Jan. 1976 30 p refs In GERMAN; FRENCH summary
(ISL-R-104/76) Avail: NTIS HC A03/MF A01

A simplified system of motion equations was set up for rapid trajectory calculation of pendulating projectiles. The system is based on axisymmetric projectiles, eliminating accounting for the roll angle. The system developed allows input of the aerodynamic coefficients as function of Mach number and angle of attack, and can therefore also be used for trajectory determination in case of large pendulation angles. A FORTRAN program was developed for calculation in a few minutes of the pendulous motion of a projectile in the initial trajectory phase. Complete trajectory calculation takes less than an hour on an IBM 370/135. ESA

N77-26918# Watervliet Arsenal, N.Y.
THE INFLUENCE OF SUPPORT CHARACTERISTICS ON THE STABILITY OF AN ELASTIC SYSTEM SUBJECTED TO A CIRCULATORY FORCE
G. L. Anderson Mar. 1977 37 p refs
(DA Proj. 1F1-61102-A-35D)
(AD-A037929; WVT-TR-77008) Avail: NTIS HC A03/MF A01 CSCL 20/11

The stability of a vertical double pendulum with elastic joints, mounted on a platform whose horizontal motion is constrained by an elastic spring and subjected to circulatory force, is examined. Attention is focused on the determination of the critical loads of divergence and flutter as functions of the platform mass and spring stiffness parameters, which characterize the effects of the support on the stability of the double pendulum. The frequency equation is derived, and several typical eigencurves are plotted in the load-frequency plane. Stability maps in the load-tangency coefficient plane indicate the existence of regions of stability, divergence and flutter. Certain boundary curves of these regions are strongly dependent upon the values of the parameters that characterize the support. GRA

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N77-26919* National Aeronautics and Space Administration. Pasadena Office, Calif.
DISTRIBUTED FEEDBACK ACOUSTIC SURFACE WAVE OSCILLATOR Patent
Charles Elachi, inventor (to NASA) (JPL) Issued 24 May 1977 7 p Filed 12 Sep. 1975 Supersedes N75-32323 (13 - 23, p 2905) Sponsored by NASA
(NASA-Case-NPO-13673-1; US-Patent-4,025,876; US-Patent-Appl-SN-613004; US-Patent-Class-331-107A; US-Patent-Class-330-5.5; US-Patent-Class-333-72) Avail: US Patent Office CSCL 20A

An acoustic surface wave oscillator is constructed from a semiconductor piezoelectric acoustic surface wave amplifier by providing appropriate perturbations at the piezoelectric boundary. The perturbations cause Bragg order reflections that maintain acoustic wave oscillation under certain conditions of gain and feedback. Official Gazette of the U.S. Patent Office

N77-26920*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A COMPARISON OF TWO INDEPENDENT MEASUREMENTS AND ANALYSIS OF JET AIRCRAFT FLYOVER NOISE
Robert N. Hosier Washington Jun. 1977 74 p refs
(NASA-TN-D-8379) Avail: NTIS HC A04/MF A01 CSCL 20A

Flyover noise measurements were made simultaneously by two groups. The measurements were made close to one another for the same flyover conditions and with similar measurement procedures, but with different acoustic equipment and personnel. Each group also independently processed the data in accordance with FAR 36 procedures, indluding corrections to reference meteorological, performance, and flight-path conditions. Measured and corrected data, from 24 controlled flyovers processed by both groups, are compared and the differences in the results obtained by the two groups are discussed. It is observed that the average value of the difference between the groups' measured acoustic descriptors (PNL, PNLTM, and EPNL) was less than or = 0.8 db; the average difference for the corrected descriptors (PNL, PNLTM, and EPNL) was less than or = 1.5 db. Causes of the differences were found to be mainly related to different spectrum extrapolation and preemphasis techniques used by the two groups. Author

N77-26921# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
NOISE MEASUREMENTS OF A CULLUM DETUNER AT THE WOENSDRECHT AIRFIELD
T. Houtgast and A. M. Mimpen 1976 10 p refs In DUTCH; ENGLISH summary
(Contract A75/KL/121)
(IZF-1976-4; TDCK-67496) Avail: NTIS HC A02/MF A01

The possible negative effect of a modification of a Cullum detuner was investigated. Indoor and outdoor noise measurements were performed while testing the J-79 motor. Earlier noise measurements, taken before the recent modification, served as a reference. From a comparison of the old and new data it is concluded that any increase of the db(A) level in the far field

resulting from the modification does not exceed 5 db. The indoor levels are virtually unchanged. Author (ESA)

N77-26922# Bristol Univ. (England). Dept. of Aeronautical Engineering.
AN APPROACH TO LOW NOISE AXIAL FLOW FAN DESIGN, MANUFACTURE AND TESTING Ph.D. Thesis
Donald George Shapland Mar. 1976 211 p refs
Avail: NTIS HC A10/MF A01

The design, construction, and testing of a low noise axial flow ventilation fan is reported. A test rig was used which allows accurate evaluation of both noise and aerodynamic performance. It became apparent that certain restrictions on noise measurement apply when using an anechoic duct terminated system. These restrictions are due to the presence of acoustic standing waves the precise structure of which is impossible to calculate in a complex duct system. Results obtained from performance measurement of the design originally considered to be of low noise performance suggest that some parameters were incorrectly used and others were omitted. A new specification for low noise fans is therefore presented following discussion of the noise criteria used, and it is considered that, if these are incorporated in a new design, a fan should result of the same aerodynamic performance but with a much lower noise rating. Author (ESA)

N77-26923# Naval Postgraduate School, Monterey, Calif.
AEOLIAN TONES FROM CIRCULAR CYLINDERS OF NON-UNIFORM CROSS SECTION Ph.D. Thesis
Steven Robert Cohen Jun. 1976 281 p refs
(AD-A035994) Avail: NTIS HC A13/MF A01 CSCL 20/1

Lighthill's theory of aerodynamic sound is reviewed. Applications of this theory to different cylinder classes are synthesized and extended to cylinder types not addressed previously. An experiment wherein cylinders are placed in an open jet, permitting simultaneous measurement of total lift force, correlation parameters and radiated sound intensity, is conducted. Over the Reynolds number range 1,000 to 50,000, the theory of aerodynamic sound is validated for uniform, roughened, skewed, finned and notched cylinders and for cylinders with splitter plates. Reduction of lift force, by any means, is shown to reduce radiated sound intensity, and local lift force is found to vary monotomically with the two dimensionality of the vortex wake. Author (GRA)

N77-26924# National Bureau of Standards, Washington, D. C.
NOISE EMISSION MEASUREMENTS FOR REGULATORY PURPOSES Final Handbook
D. R. Flynn, W. A. Leasure, Jr., A. I. Rubin, and M. A. Cadoff Mar. 1977 195 p refs Prepared in cooperation with EPA, Washington, D. C.
(PB-264667/7; NBS-HB-122; EPA-550/9-77-401; LC-76-608406) Avail: NTIS HC A09/MF A01 CSCL 13B

A review is given of the measurement needs attendant to regulation of the noise generated and emitted by commercial products. The emphasis is primarily on measurement procedures for use in conjunction with point-of-sale regulations as opposed to regulations on the noise which a source actually emits when in operation. The report is divided into three major parts: a discussion of overall measurement requirements and the type of data and information which are needed in order to promulgate regulations based on appropriate measurement techniques; a checklist for the evaluation of the suitability of a noise measurement standard for a particular class of products or, in the absence of a suitable standard, as a framework for development of one. The intent is to identify and discuss in some detail those factors which can impact on the accuracy, precision, and applicability of a noise measurement process; and a series of flow charts depicting the development of appropriate procedures for the measurement of product noise emission. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N77-26925 British Library Lending Div., Boston Spa (England).
RADIONUCLIDIC IMPURITIES IN 99Mo(99m) Tc GENERATORS, THEIR MEASUREMENTS AND IMPORTANCE
V. Husak, L. Kokta, J. Vlcek, and V. Dvorak [1976] 36 p refs Transl. into ENGLISH from Radioisotopy (Prague), v. 16, no. 1, 1975 p 1-35
(BLL-RTS-10018) Avail: British Library Lending Div., Boston Spa, Engl.: £10.00; 13 BLL overseas, or 39 UK BLL photocopy coupons

Basic information on contaminating radionuclides in Tc-99m eluates from Mo-99 Tc-99m generators is presented. Attention is paid to the most commonly used column chromatography method of Tc-99m preparation; extraction and sublimation methods are also mentioned. A simple method for estimating the additional radiation burden on examined persons due to contaminating radionuclides is described. A survey of permissible contaminant activities in eluates laid down by foreign and Czechoslovak regulations is presented. Methods for identification and activity measurement of contaminants in eluates before administration to patients and after Tc-99m activity decay are discussed. The results of long-term monitoring of radionuclidic purity of imported generators and estimated values of the contribution from contaminants to the absorbed dose rate are presented. Author

N77-26926*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TWO PHOTON EXCITATION OF ATOMIC OXYGEN
Michael S. Pindzola Jun. 1977 24 p refs Submitted for publication
(NASA-TM-X-71344; X-602-77-161) Avail: NTIS HC A02/MF A01 CSCL 20H

A standard perturbation expansion in the atom-radiation field interaction is used to calculate the two photon excitation cross section for 1s(2) 2s(2) 2p(4) p3 to 1s(2) 2s(2) 2p(3) (s4) 3p p3 transition in atomic oxygen. The summation over bound and continuum intermediate states is handled by solving the equivalent inhomogeneous differential equation. Exact summation results differ by a factor of 2 from a rough estimate obtained by limiting the intermediate state summation to one bound state. Higher order electron correlation effects are also examined. Author

N77-26927# Texas Univ., Austin. Dept. of Chemistry.
ENERGY AND CHEMICAL CHANGE Final Report, 1 Jun. 1974 - 31 Oct. 1976
R. D. Levine and R. B. Bernstein 27 Dec. 1976 10 p refs (Grant AF-AFOSR-2725-74)
(AD-A035695; AFOSR-77-0061TR) Avail: NTIS HC A02/MF A01 CSCL 09/4

The information theoretic approach to branching ratios has been applied to a number of different processes. The main practical conclusion of this work is that for direct, exoergic reactions with low activation barriers, even in the absence of any other knowledge, the 'prior' branching ratio, which is very easy (slide rule) to estimate, already provides a useful guide. Exact quantal close coupling computations were carried out for atom-atom collisions. Comparisons were carried out with more approximate (e.g., Landau- Zener) treatments leading to practical conclusions regarding the coupling constants for such processes. The information theoretic analysis and synthesis of cross sections for rotational energy transfer in atom-diaton collision was studied in considerable detail. It was found possible to simulate an entire matrix of state-to-state cross sections by two constants. One of the two is just a scale factor for the absolute magnitude of the cross sections. The relative magnitudes are governed (to the first approximation) by a single parameter. It was found possible to provide ready estimates for this parameter which measures the importance of the energy 'mismatch' in the collision. The concept of the 'prior' distribution was clarified. GRA

N77-26928# Wisconsin Univ., Madison. Dept. of Nuclear Engineering.
INELASTIC MOLECULAR COLLISIONS: APPLICATIONS OF THEORETICAL METHODS TO PROBLEMS IN RELAXATION PHENOMENA AND LASER OPERATION Progress Report, 1 Feb. - 1 Nov. 1976
R. W. Conn 1976 33 p refs

(Contracts AT(11-1)-2555; AT(11-1)-2542)
(TID-27235) Avail: NTIS HC A03/MF A01

The main goals of this research are to develop and implement various techniques for describing molecular collision phenomena. The aim is to achieve sufficient understanding of these processes such that collision rates of interest (e.g., for gas lasers) may be reliably estimated. Several areas of research are being explored to achieve this goal. The specific molecular systems of H2-H2, HF-He, HF-Ar and HCl-Ar are being studied as examples of inelastic molecular collisions. In addition, during the past year further theoretical development was conducted in the area of decomposition techniques and effective Hamiltonian theory. Considerable progress was made in these various areas during the past year. ERA

N77-26929# California Inst. of Tech., Pasadena. Chemical Physics Lab.

CLASSICAL DYNAMICS OF TRIATOMIC SYSTEM: ENERGIZED HARMONIC MOLECULES

C. A. Parr, A. Kuppermann, and R. N. Porter (State Univ. of New York, Stoney Brook) 1976 59 p refs
(Contract E(04-3)-0767)
(CALT-767P4-49; Contrib-5290) Avail: NTIS HC A04/MF A01

The dynamical assumptions underlying the Slater and RRK classical mechanical theories of unimolecular reaction rates are investigated. The predictions of these theories for several nonlinear, triatomic, harmonically-bonded molecular models are compared with the results obtained from the integration of the classical equations of motion. The accuracy of the small-vibration and weak coupling assumptions are found to break down at energies above about one quarter of a bond dissociation energy. Nonetheless, the small-vibration approximation predicts reaction frequencies in good agreement with the exact results for the models. The effects of rotation on intramolecular energy exchange are examined and found to be significant. ERA

N77-26930# Wayne State Univ., Detroit, Mich. Dept. of Chemistry.

RADIOLYSIS STUDIES ON REACTIVE INTERMEDIATES Technical Progress Report, 1 Nov. 1975 - 1 Nov. 1976

Larry Kevan Nov. 1976 28 p refs
(Contract EY-76-S-02-2086)
(COO-2086-87) Avail: NTIS HC A03/MF A01

The development of experimental electron magnetic resonance methods and theoretical models to study reactive reaction intermediates, and the application of these and other methods to study radical and ionic intermediates produced by high energy radiation are described. Electron spin echo spectrometry for studying molecular orientation around trapped radicals, an electron spin-lattice relaxation mechanism applicable to glasses, a correlation between electron spin-lattice relaxation times and trapped radical decay, and how electron-electron double resonance measurements of cross relaxation can be analyzed to give radical-radical correlation distances are included. A model of electron localization in alkanes was developed, electron solvation in alcohol-alkane mixtures was studied theoretically, and an improved model of electron solvation times was formulated. Radical reaction intermediates were detected and identified by spin trapping in methanol, cyanoalkyl and fluoroalcohol liquids, and by X and Q band ESR in methyltetrahydrofuran glass. ERA

N77-26931# Colorado Univ., Boulder.

THEORETICAL RESEARCH IN PHYSICS OF HIGHLY IONIZED ATOMS Final Report, 1 Mar. 1975 - 30 Jun. 1976

J. Norman Bardsley and David W. Norcross 1976 28 p refs
(Contract EY-76-S-02-2557)
(COO-2557-1) Avail: NTIS HC A03/MF A01

Results of a preliminary study of the use of a model potential approach to the calculation of energy levels and radiative transition probabilities for highly ionized heavy atoms are reported. The calculations were carried out for eight ions in the sodium isoelectronic sequence from Mg II through W LXIV. The technique used involved the solution of the Dirac equation for the single outer valence electron, with a model central potential containing two disposable parameters affecting the potential in the region of the atomic core. The effect of core polarization was incorporated in the model potential. The parameters in the model potential were chosen by an initial solution of the nonrelativistic Schroedinger equation for the single outer valence electron, with the requirement that calculated ionization energies reproduce the results of the best available nonrelativistic calculations. The results, for both energy levels and radiative transition probabilities, are encouraging, and suggest that the wave functions obtained will be quite satisfactory for subsequent calculations of electron impact excitation of these ions. ERA

N77-26932# Oak Ridge National Lab., Tenn.

ACCELERATOR BASED ATOMIC PHYSICS EXPERIMENTS: AN OVERVIEW

C. D. Moak 1976 5 p refs Presented at the 4th Annual Conference on the Use of Small Accelerators, Denton, Texas, 25 Oct. 1976
(Contract W-7405-eng-26)
(CONF-761059-6) Avail: NTIS HC A02/MF A01

Atomic Physics research with beams from accelerators reflects a steadily increasing interest and an increasing support from various funding agencies. Examples are cited where interdisciplinary benefits have occurred, and where applications of the new results to engineering problems are expected. A list of the most active areas of research is presented. Accelerator based atomic physics brings together techniques from many areas, including chemistry, astronomy and astrophysics, nuclear physics, solid state physics and engineering. An example is the use of crystal channeling to sort some of the phenomena of ordinary heavy ion stopping powers. This tool has helped us to establish a better base for predicting energy losses of heavy ions in various materials. ERA

N77-26933# Argonne National Lab., Ill.

DISSOCIATION OF FAST MOLECULAR-ION BEAMS IN THIN FOILS

Donald S. Gemmell, Zeev Vager, and B. J. Zabansky 1976 6 p refs Presented at the 4th Ann. Conf. on the Use of Small Accelerators, Denton, Texas, 25-27 Oct. 1976
(Contract W-31-109-eng-38)
(CONF-761059-17) Avail: NTIS HC A02/MF A01

Distributions in angle and in energy were measured for the break-up fragments produced when fast beams of molecular ions bombard thin foil targets. Studies were made using both amorphous and crystalline targets. The results display some dramatic departures from expectations based on a simple Coulomb explosion picture in which a cluster of nuclei stripped of their binding electrons move apart under the influence of their mutual Coulomb repulsion. An explanation for these differences is offered in terms of an interaction between the projectiles and polarization oscillations induced in the target by the passage of the clusters. A theoretical model is outlined which accounts for the total electronic stopping power of the solid and gives good agreement with the experimental results on dissociation of fast molecular-ion beams. Data obtained for the heavier molecules show interesting possibilities for determining effective charges inside solids. ERA

N77-26934# Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).

MEASURING THE RADIOACTIVITY OF DRINKING WATER WITH THE LIQUID COUNTERS M2H IN COMBINATION WITH CONTAMINATION METERS IM 4457 [METING VAN DE RADIOAKTIVITEIT VAN DRINKWATER MET DE VLOEISTOFTELBUIZEN M2H IN COMBINATIE MET BESMETTINGSMETERS IM 4457]

J. J. VanHemmen, L. P. VanHoek, and J. B. T. Aten 1976 14 p In DUTCH
(Contract A75/KL/080)
(MBL-1976-10; TDCK-68321) Avail: NTIS HC A02/MF A01

The relationship between the meter indications and the radioactivity of fission products in drinking water for the combination contamination meter IM 4457 and liquid counter M2H was investigated. The experimental setup is presented, the efficiency of the liquid counter for a mixture of fission products is briefly dealt with, and the use of the combination counter/meter in the field is discussed. ESA

N77-26935# Ohio State Univ. Research Foundation, Columbus.

APPLICATION OF AN ELECTRON BEAM TO HIGH DENSITY

FLOWS OF N2, O2 AND NO Final Report, 1 Apr. 1974 - 30 Sep. 1975
S. L. Petrie Dec. 1976 90 p refs
(Contract F33615-76-C-3070; F33615-76-C-3112; AF Proj. 1426; AF Proj. 1926)
(AD-A037197; OSURF-3890; AFFDL-TR-76-147) Avail: NTIS HC A05/MF A01 CSCL 20/8

The electron beam fluorescence technique was investigated for measuring the vibrational temperatures and number densities of molecular nitrogen, nitric oxide, and molecular oxygen at densities up to those corresponding to a static pressure of 50 torr and a temperature of 300 K. Comparative tests were conducted in a static chamber and in an arc heated wind tunnel. GRA

N77-26938# Office of Naval Research, London (England).
INTERNATIONAL CONFERENCE ON RADIATION EFFECTS IN SEMICONDUCTORS
Neal D. Wilsey (NRL, Washington, D. C.) and James H. Schulman 24 Jan. 1977 8 p
(AD-A036994; ONRL-C-39-76) Avail: NTIS HC A02/MF A01 CSCL 20/12

Selected papers given at this Conference are briefly reviewed. The meeting emphasized how much is still unknown concerning the nature of defects in semiconductors other than silicon, as well as the need to develop other microscopic probes for investigating materials that are not readily amenable to ESR studies. Author (GRA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N77-26937 Materials Research Labs., Melbourne (Australia).
THE SHIELDING OF A 14 MeV NEUTRON GENERATOR
D. R. Brighton Oct. 1976 17 p refs
(MRL-TN-387) Copyright. Avail: Issuing Activity

A concrete masonry shield for a 14 MeV neutron generator was designed. Subsequent radiation surveys outside the shield showed doses higher than expected. Calculations indicated the sensitivity of dose transmission factors to concrete composition. Measurements and calculations delineated the contribution that neutrons, scattered from the upper wall that supports the laboratory roof, made to the dose in adjoining areas. In redesigning the shield, a compromise was made between additional cost and restrictions on the generator's duty cycle, which is automatically controlled to ensure personnel safety. Author

N77-26938# California Univ., Livermore. Lawrence Livermore Lab.
STATUS OF LASER FUSION
J. H. Nuckolls 20 Oct. 1975 60 p Presented at Am. Phys. Soc. Meeting, St. Petersburg, Fla., 10 Nov. 1975
(Contract W-7405-eng-48)
(UCRL-77056; Conf-751130-44) Avail: NTIS HC A04/MF A01

Several significant results were achieved in these experiments. The fuel underwent large entropy changes during implosion and did not reach high densities. Consequently, the sensitivity to fluid and plasma instabilities was greatly reduced. A summary of these implosion experiments is presented. ERA

N77-26939# California Univ., Berkeley. Lawrence Berkeley Lab.
LECTURES ON THE NEW PARTICLES
18 Aug. 1976 114 p refs Presented at the SLAC Summer Inst. on Particle Phys., Stanford, Calif., 2-13 Aug. 1976
(Contract W-7405-eng-48)
(LBL-5500; Conf-760849-1) Avail: NTIS HC A06/MF A01

Systematics of new particles and their spectroscopy are discussed in a simple manner. The main emphasis is on charm and SU(4), weak decays of charmed mesons, hadronic masses, and charmonium. ERA

N77-26940# Los Alamos Scientific Lab., N. Mex.
ENERGY DEPENDENT FINITE ELEMENT METHOD FOR TWO-DIMENSIONAL DIFFUSION PROBLEMS
H. Komoriya and W. F. Walters 1977 19 p refs Presented at Analysis of Nucl. Systems, Tucson, Ariz., 28 Mar. 1977
(Contract W-7405-eng-36)
(LA-UR-77-59; Conf-770304-4) Avail: NTIS HC A02/MF A01

The effectiveness of the energy dependent finite element method (EDFEM) as applied to two-dimensional multigroup diffusion problems is investigated. The EDFEM couples the finite element method (FEM) formalism with the energy dependent element size scheme. The EDFEM allows the elements to straddle material interfaces if certain conditions are satisfied; this makes this method especially suitable for heterogeneous reactor calculations. Comparisons of the results obtained by the EDFEM, the FEM, and the finite difference method for a ZION-I PWR model are presented. A significant reduction of the total number of unknowns involved in the problem is accomplished using the EDFEM which yields a reduction of the computing time by 30 percent. ERA

N77-26941# Oxford Univ. (England). Dept. of Engineering Science.
A MICROCOMPUTER-BASED REACTOR SAFETY SYSTEM
S. N. Cope Jul. 1976 35 p refs
(OUEL-1159/76) Avail: NTIS HC A03/MF A01

A modular system consisting of microprocessors is proposed for control of reactor safety. The microprocessor CPU's are best checked by means of hardware. Hardware comparison of two microprocessors operating in synchronism allows errors to be detected during operation of the functional program and does not detract from its efficiency. The hardware can be made reliable through a conbination of self-checking and redundancy. In addition, it can monitor all memory and I/O data transfers by monitoring the 8-bit data bus. Programs were developed to perform the various tasks required by the reactor safety system. ESA

74 OPTICS

Includes light phenomena.

N77-26942* National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
GREGORIAN ALL-REFLECTIVE OPTICAL SYSTEM Patent
William L. King, inventor (to NASA) (Hughes Aircraft Co., Los Angeles) Issued 24 May 1977 5 p Filed 28 Apr. 1976 Supersedes N76-23984 (14 - 14, p 1855) Sponsored by NASA
(NASA-Case-GSC-12058-1; US-Patent-4,025,783; US-Patent-Appl-SN-680938; US-Patent-Class-250-199) Avail: US Patent Office CSCL 20F

An optical heterodyne receiver comprises a system of reflectors forming a folded Gregorian configuration for collecting a signal beam, and an optical detector located at the focus of the system. A paraboloidal primary reflector and an elipsoidal secondary reflector face each other on an optical axis with the focus of the secondary reflector coinciding with the focus of the primary reflector. An auxiliary laser generates a local oscillator beam that is combined with the signal beam after the signal beam emerges from the exit pupil (which is also the aperture stop) of the system, and the resultant is impinged on the detector. A pair of image motion compensators is located as close to the exit pupil as possible for aligning off-axis inputs to the detector. Official Gazette of the U.S. Patent Office

N77-26943*# Perkin-Elmer Corp., South Pasadena, Calif. Boller and Chivens Div.
DESIGN STUDY OF THE ACCESSIBLE FOCAL PLANE TELESCOPE FOR SHUTTLE Final Report
Apr. 1976 138 p refs
(Contract NAS9-14684)
(NASA-CR-151440) Avail: NTIS HC A07/MF A01 CSCL 20F

The design and cost analysis of an accessible focal plane

telescope for Spacelab is presented in blueprints, tables, and graphs. Topics covered include the telescope tube, the telescope mounting, the airlock plus Spacelab module aft plate, the instrument adapter, and the instrument package. The system allows access to the image plane with instrumentation that can be operated by a scientist in a shirt sleeve environment inside a Spacelab module. Author

N77-26944# Naval Intelligence Support Center, Washington, D. C. Transl. Div.

EXPERIMENTAL STUDY OF THE DIFFUSION OF THE SHAPE OF A LASER LIGHT PULSE DURING ITS PROPAGATION IN THE SEA

I. I. Kalinin, V. N. Pelevin, A. L. Skrelin, and D. M. Sherbaf 1 Feb. 1977 6 p refs Transl. into ENGLISH from Mono. Optika Okeana I Atmosfery, Leningrad, 1972 p 168-173 (AD-A036880; NISC-Trans-3887) Avail: NTIS HC A02/MF A01 CSCL 20/6

The development of the instruments for studying light scattering in the sea may be considered tentatively completed. Quantitative characteristics have been obtained which make it possible to make the first estimates of the parameters of the pulse transfer function of the process. It was found necessary to increase the time resolution of the detector even more and decrease the duration of the sounding pulse. Continuation of experimental studies in ocean waters of high transparency would make it possible to improve the quality of measurements using existing equipment with the already achieved time resolution. GRA

N77-26945# Sira Inst. Ltd., Chislehurst (England).

DEVELOPMENT STUDY FOR A HIGH ACCURACY STAR SENSOR. VOLUME 1: STUDY AND DEVELOPMENT OF AN OUTLINE CONCEPT

S. E. Cole, R. A. Brook, D. J. Purll, D. R. Lobb, W. Strang, and C. Rowbotham Jul. 1976 197 p refs 2 Vol. (Contract ESTEC-2454/75) (ESA-CR(P)-923-Vol-1) Avail: NTIS HC A09/MF A01

A broad range of star sensing techniques was studied on a variety of detector systems covering image tubes currently used in similar applications and detectors which, although still at the development stage, are judged suitable candidates for future star sensors. The major conclusion is that future star sensors and subsequent phases in the development program should be based on the use of charge coupled imaging devices (CCD). Although CCD are not sufficiently advanced in development to allow an ideal instrument to be produced, the current work will ensure that the necessary design technology is established by the time suitable devices are available. Author (ESA)

N77-26946# Sira Inst. Ltd., Chislehurst (England).

DEVELOPMENT STUDY FOR A HIGH ACCURACY STAR SENSOR. VOLUME 2: DETAILED INVESTIGATION OF PREFERRED CONCEPT

S. E. Cole, R. A. Brook, D. J. Purll, D. R. Lobb, W. Strang, and C. Rowbotham Feb. 1977 189 p refs 2 Vol. (Contract ESTEC-2454/75) (ESA-CR(P)-923-Vol-2) Avail: NTIS HC A09/MF A01

A detailed study was carried out on a high accuracy star sensor concept incorporating a CCD area imager as the image analyzing detector. This did not result in a final sensor definition, since several presently unquantified characteristics of CCD have important implications for many aspects of the sensor design. Nevertheless, it was possible to produce outline designs for the telescope and the mechanical and data processing systems, to varying degrees of completeness. It is concluded that the random noise and bias error performance of such a sensor should be within the specification, and that the requirements on manufacture, calibration, and physical and environmental constraints can largely be met. A program to investigate the CCD characteristics in question is proposed. Author (ESA)

N77-26947# University of Southern Calif., Los Angeles. Image Processing Inst.

IMAGE PROCESSING RESEARCH Semiannual Report, 1 Sep. 1975 - 31 Mar. 1976

William K. Pratt 31 Mar. 1976 265 p refs (Contract F33615-76-C-1203; ARPA Order 3119) (AD-A035315; USCIPI-660) Avail: NTIS HC A12/MF A01 CSCL 20/6

The research program has as its primary purpose the development of techniques and systems for efficiently processing, transmitting, and analyzing visual images and two dimensional data arrays. Three tasks are reported: Image Understanding Projects; Image Processing Projects; Smart Sensor Projects. The Image Understanding Projects involve the development of generalized processing systems for analyzing images and extracting salient information. The Image Processing Projects include research on novel image coding methods, image restoration, vision modelling and nonlinear two dimensional optical filtering techniques. The Smart Sensors Projects comprise investigations of electronic and optical processing methods integrated with imaging sensors to perform feature and symbolic extraction. GRA

N77-26948# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

LOW-COST OPTICAL DATA LINK DESIGN STUDY M.S. Thesis

Richard G. Innes Dec. 1976 127 p refs (AD-A035294; GE/EE/76D-25) Avail: NTIS HC A07/MF A01 CSCL 17/2

This paper discusses some of the theoretical background and practical problems involved in designing a full duplex 1.5 Mb/sec optical data link. The actual design of a fiber-optic link and an atmospheric link is treated for an atmospheric path length of 1.372 Km and a fiber path length of 2 Km. Complete designs to the block diagram level are presented, and additional details are described for the modulator circuit for the CW laser diode and LED used in the atmospheric and fiber transmitters. Also presented is sufficient data to permit calculation of the various losses encountered in fiber and atmospheric links. It is shown that currently available LED's and low-loss graded-index optical fibers should permit production of a 2 Km long fiber optic data link to handle a data rate of 1.5 Mb/s with an error rate of less than 10 to the minus 5th power. GRA

N77-26949# Maryland Univ., College Park. Computer Science Center.

ALGORITHMS AND HARDWARE TECHNOLOGY FOR IMAGE RECOGNITION Quarterly Report, 1 May - 31 Jul. 1976

Azriel Rosenfeld and David Milgram 31 Jul. 1976 140 p refs (Contract DAAG53-76-C-0138; DARPA Order 3206) (AD-A035039) Avail: NTIS HC A07/MF A01 CSCL 17/5

Techniques for detecting tactical targets on Forward-Looking Infrared (FLIR) imagery are being investigated. The principal topics covered include target and background models, object extraction and classification, and hardware technology applicable to real-time implementation. Author (GRA)

N77-26950# Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.

A METHOD TO OBTAIN DIFFUSE REFLECTIVE MEASUREMENTS FROM 1.0 TO 3.0 MICROMETERS USING A CARY 17I SPECTROPHOTOMETER

James B. Gillespie and James D. Lindberg Nov. 1976 22 p refs (DA Proj. 1L1-61102-B-53A) (AD-A035031; ECOM-5806; OSD-1366) Avail: NTIS HC A02/MF A01 CSCL 14/2

This report describes a way to perform diffuse reflectance measurements over the 1.0 to 3.0 micrometers spectral interval by using a Cary 17I Spectrophotometer equipped with inexpensive standard accessory cell-space integrating spheres. The method involves coating the cell-space spheres with a powder of pure grade quenched sulfur with carbon disulfide used as a solvent and making a minor alteration in an electronic amplifier. A spectrum of ground gypsum crystal in the 2.6 to 3.0 micrometers spectral region and a spectrum of a layer of Hectorite clay in the 1.0 to 3.0 micrometers spectral region are presented to illustrate the applicability of the above technique for making diffuse reflectance measurements in the near infrared. Author (GRA)

N77-26951# Northrop Corp., Anaheim, Calif. Electro-Mechanical Div.
EXPERIMENTAL DEVELOPMENT OF A FLIR SENSOR PROCESSOR Quarterly Report, 1 Jul. - 30 Sep. 1976
T. Noda, H. Henning, T. Leiboff, G. Robinson, and T. Baxter 30 Nov. 1976 62 p refs 2 Vol.
(Contract DAAG53-76-C-0188)
(AD-A037143; NORT-76Y133A; QR-1) Avail: NTIS HC A04/MF A01 CSCL 17/5

This report summarizes the technical performance through September 30, 1976, and marking the completion of Task 1, Experiment and Study Plan, of Contract No. DAAG53-76-C-0188. Section 2 contains a brief Advanced Scout Helicopter mission scenario used to bound the problem of a FLIR operating in a difficult environment. Section 3 provides a basic definition of the Haar functions, since the Haar transform provides the basis for all the image processing techniques presented in this report. Section 4 describes a set of image descriptors designed to facilitate the evaluation of images and image processing algorithms throughout the course of this study. Section 5 includes the basic approach for conducting the experiments, Tasks 2 through 6 of the contract. GRA

N77-26952# Northrop Corp., Anaheim, Calif. Electro-Mechanical Div.
EXPERIMENTAL DEVELOPMENT OF A FLIR SENSOR PROCESSOR Quarterly Report
T. Noda, H. Henning, T. Leiboff, and B. Deal 17 Feb. 1977 54 p ref 2 Vol.
(Contract DAAG53-76-C-0188)
(AD-A037142; NORT-77Y016A; QR-2) Avail: NTIS HC A02/MF A01 CSCL 17/5

This report, which covers the work performed during the second quarter, primarily concerns the autofocus experiments. The object was to determine the use of the 2D Haar processor as an accurate sensor on in-focus/defocus conditions in FLIR systems. To validate this use, a series of measurements were taken to determine sensitivity, accuracy, and repeatability 'temporaily substituting a camera for the FLIR'. Initial measurements were made using a RETMA resolution chart. This was followed by using thermograms provided by NVL. The analysis and graphed results show the effect of focus adjustment on the ac magnitudes and ac power of the Haar coefficients and the generalized descriptors. Using imagery with some amount of activity within the view, it can be shown that a simple scalar value can be computed in real time, which has a sensitivity greater than the eye in determining best focus. The second part of this report discusses the automatic deblurring experiments, which have already been started and are planned to continue into the following quarter. GRA

N77-26953# Naval Intelligence Support Center, Washington, D. C. Translation Div.
DETERMINATION OF THE LIGHT QUANTUM SURVIVAL PARAMETER FROM THE CHARACTERISTICS OF LIGHT FIELDS IN THE SEA
T. M. Prokudina and V. N. Pelevin 1 Feb. 1977 10 p refs Transl. into ENGLISH from the book "Optika Okeana i Atmosfery" Leningrad, Nauka Publishing House, 1972 p 157-168
(AD-A036879; NISC-Trans-3886) Avail: NTIS HC A02/MF A01 CSCL 20/6

An important optical characteristic of seawater is the ratio of the light scattering index sigma to the attenuation index epsilon, called the quantum survival parameter, which in many cases is known with sufficient confidence. The widely used method of determination of this quantity involving separate measurement 1 of sigma and epsilon is frequently associated with large instrumental errors. GRA

N77-26954# Worcester Polytechnic Inst., Mass. Dept. of Physics.
NON-LINEAR OPTICAL AMPLIFICATION AND ABSORPTION Final Report, 1 Jan. - 31 Dec. 1976
Lorenzo M. Narducci 25 Feb. 1977 60 p refs
(Grant DAAG29-76-G-0075)
(AD-A037103; ARO-13603.1-R-P) Avail: NTIS HC A04/MF A01 CSCL 20/5

This report summarizes the main results of theoretical and experimental investigations on two-photon interaction processes. Theoretical investigations have been directed to the analysis of the evolution of an optical pulse through a pumped medium which operates as a two-photon amplifier. The physical model under consideration consists of a collection of atoms prepared in a state of inversion between two levels of the same parity. An incident pulse with a carrier frequency approximately equal to one-half the atomic transition frequency stimulates an induced nonlinear polarization which oscillates with the same carrier frequency as the incident pulse. The evolution of the coupled atom-field system is described without restriction on the duration of the incident pulse and of the atomic relaxation times. Under coherent propagation conditions, i.e. when the pulse duration is much shorter than the atomic relaxation time, considerable pulse sharpening and power amplification is possible above threshold. In the rate equation limit, a regime where the atomic relaxation times are much shorter than the pulse duration, optimum amplification conditions occur when the frequency of the incident pulse is detuned from its resonance value. The entire range from the coherent to the rate equation limit is explored with the help of hybrid and digital computer simulations. Experimental investigations have lead to the measurement of the two-photon absorption constant in ZnS using a Q-switched ruby laser as the source. The measured value of the absorption constant is 0.013 cm/MW. GRA

N77-26955# California Univ., Los Angeles. School of Engineering and Applied Science.
THEORETICAL STUDIES OF FIBER OPTICAL WAVEGUIDES AND INTEGRATED OPTICAL CIRCUITS Final Report, Mar. 1973 - Feb. 1976
C. Yeh Jul. 1976 20 p refs
(Contract N00123-73-C-1192)
(AD-A035643; UCLA-ENG-7671) Avail: NTIS HC A02/MF A01 CSCL 17/2

This report summarizes the results of the research carried out at the Electrical Sciences and Engineering Department of the University of California at Los Angeles under Contract N00123-73- C-1192-00003 with the Naval Electronics Laboratory Center, Department of the Navy. The report covers activities during the period March 1973 to February 1976. The research dealt in general with the theoretical studies of fiber optical waveguides and integrated optical circuits. Author (GRA)

N77-26956# Pattern Analysis and Recognition Corp., Rome, N. Y.
PROCESSING OF FLIR DATA ON DICIFER Final Technical Report, Jul. 1975 - Jun. 1976
Dennis J. Lucey, George E. Forsen, and Michael J. Zoracki Jul. 1976 108 p refs
(Contract DAAG53-75-C-0277)
(AD-A037136; PAR-76-26) Avail: NTIS HC A06/MF A01 CSCL 17/5

This effort has investigated the extent to which automatic tactical target cueing on selected FLIR (forward-looking infrared) imagery can be accomplished using digital image processing and automatic pattern recognition techniques. The DICIFER (Digital Interactive Complex for Image Feature Extraction and Recognition) system was utilized to analyze FLIR image data for the U.S. Army Night Vision Laboratory (NVL). DICIFER is a general purpose R and D tool developed by Pattern Analysis and Recognition (PAR) Corporation for Rome Air Development Center (RADC) Intelligence and Reconnaissance Division (IR). A digital process for automatic detection of tactical targets in FLIR images was designed and tested. The total process included noise removal and contrast enhancement preprocessing; gradient edge detection and boundary chain encoding; and the design of Boolean classification logic. The classification logic was applied against a test set of 34 images. The probability of detection achieved was 88% (38 of 43 targets detected). Author (GRA)

N77-26957# Texas Instruments, Inc., Dallas. Equipment Group.
DEVELOPMENT OF GALLIUM ARSENIDE FOR INFRARED WINDOWS Final Report, 25 Jun. 1975 - 25 Jun. 1976
Harold C. Hafner and Maurice J. Brau Sep. 1976 48 p refs
(Contract F33615-75-C-5274)
(AD-A037336; AFML-TR-76-163) Avail: NTIS

HC A03/MF A01 CSCL 17/5

A program was initiated to scale-up from 6 by 4 by 0.5 inch to 6 by 12 by 0.5 inch, a GaAs gradient-freeze process for producing gallium arsenide infrared windows. A process was developed that permits the production of gallium arsenide at atmospheric pressure, using a helium vent system. GaAs plates up to 6 by 12 by 0.4 inch were produced by this technique. The atmospheric process also permits further scale-up because ampuls can be easily fabricated and do not require special sizes, shapes and thicknesses. The dn/dt of gallium arsenide was measured and reported. The transmittance of the plates produced was measured and reported. Author (GRA)

N77-26958# Science Applications, Inc., Ann Arbor, Mich.
THERMAL IMAGING SYSTEMS RELATIVE PERFORMANCE: 3-5 MICROMETERS vs 8-12 MICROMETERS Final Report, 30 Mar. - 30 Jun. 1976
Thomas W. Tuer Jan. 1977 110 p refs
(Contract DAEA18-73-A-0127; AF Proj. 2004)
(AD-A037248; SAI-76-005-AA; AFAL-TR-76-217) Avail: NTIS HC A06/MF A01 CSCL 17/5

The performance of a thermal imaging system operating in the 3-5 micrometers window relative to a system operating in the 8-12 micrometers window is calculated parametrically. Airborne systems operating against typical ground targets are evaluated using Barhydt's system performance model with sophisticated models for atmospheric transmission (Lowtran III) and path radiances, and for target and terrain radiances. Present results are found to be in general agreement with previous analyses, considering the differences in conditions assumed. Author (GRA)

N77-26959# Arkansas Univ., Fayetteville. Electrical Engineering.
INFRARED RESPONSE OF IMPURITY DOPED SILICON MOSFET'S (IRFET'S) Final Technical Report, 1 Aug. 1974 - 1 Aug. 1976
Leonard Forbes Nov. 1976 164 p refs
(Contract F19628-75-C-0071; ARPA Order 2794)
(AD-A036871; RADC-TR-76-357) Avail: NTIS HC A08/MF A01 CSCL 17/5

Operation and characteristics of the impurity doped infrared sensing MOSFET IRFET are described. Responsivities of over 1,000 amps/joule have been observed with only small channel width to length ratios and large area devices. Much higher responsivities would be possible with smaller area devices. In the case of indium and gallium-doped devices it has been shown that quantum efficiencies in the range 1.0 to 10.0% can be achieved by using substrats with low boron dopings. The infrared sensing, MOSFET, IRFET is a detector, integrating element, and amplifier all combined in one device structure. As such it is distinctly different than other types of infrared detectors and possesses many very unique characteristics. When compared to CCD scanned photoconductors two of these are: (1) the responsivity of the IRFET and uniformity of responsivity do not depend upon carrier life-time and residual impurity concentration, (2) the IRFET has a nondestructive dc or static memory type readout as opposed to the ac or dynamic memory type of CCD's. This report describes in detail the experimental results obtained on gold-, and gallium-doped devices for use in the near, middle, and far infrared wavelength regions respectively. GRA

N77-26960# National Bureau of Standards, Washington, D. C.
OPTICAL MATERIALS CHARACTERIZATION Semiannual Technical Report, 1 Aug. 1976 - 31 Jan. 1977
Albert Feldman, Deane Horowitz, Roy M. Waxler, Marilyn J. Dodge, and Warren K. Gladden Mar. 1977 37 p refs
(ARPA Order 2620)
(AD-A037525; NBSIR-77-1219) Avail: NTIS HC A03/MF A01 CSCL 11/7

The refractive indices of three prisms of chemical vapor deposited ZnS were measured at room temperature over the wavelength range 540 nm to 1.083 micrometers. The refractive indices of eight specimens of CaF2 doped with Er were measured from 404.7 nm to 1.083 micrometers. The doping range was 0.001% to 3% Er. Interferometric measurements of dn/dT were made over the temperature range -180 to 200 C at the wavelengths 632.8 nm and 3.39 micrometers on single crystal specimens of BaF2, CaF2, reactive atmosphere processed (RAP) KBr, RAP KCl, KCl, doped with KI, LiF, NaF and SrF2, and on chemical vapor deposited (CVD) ZnSe and hot forged CaF2. Author (GRA)

N77-26961# Northrop Research and Technology Center, Hawthorne, Calif.
OPTICAL COATINGS 2-6 MICRONS
Paul Kraatz Jan. 1977 59 p refs
(Contract N00123-76-C-1321)
(AD-A037257; NRTC-77-8R) Avail: NTIS HC A04/MF A01 CSCL 11/3

This report documents results of characterization and testing of substrate and coating materials to be employed in the main thrust of the contractual effort, optimization of coatings for 2-6 micrometers laser optics. Principal results comprise X-ray diffraction analyses of the coating materials, documentation of substrate surface finish, total absorptance of CaF2 and SrF2 substrates at 3.8 and 5.3 micrometers, and results of a study of substrate surface chemistry as affected by cleaning procedures. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N77-26962 British Library Lending Div., Boston Spa (England).
THEORY AND CALCULATIONS ON NON-MAGNETIC CONFINEMENT OF A DENSE PLASMA
G. E. Vekshtein, V. V. Mirnov, D. D. Ryutov, and P. Z. Chebotaev [1977] 18 p refs Transl. into ENGLISH from Russian Paper IAEA-CN-5/E-21 Presented at 6th IAEA Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Berchtesgaden, West Ger., 6-13 Oct. 1976
(BLL-CTO-1291-(9091.9F); IAEA-CN-35/E-21) Avail: British Library Lending Div., Boston Spa, Engl.

The characteristic features of nonmagnetic confinement are clarified. These include the excitation of radial plasma flows, the formation of a dense layer of cold plasma near the walls, and an increase in the part played by bremsstrahlung losses. Analytical solutions describing the behavior of a plasma during pulsed and quasi steady state heating by a high current electron beam are found. The results of numerical calculations aimed at determining the parameters of a critical reactor are presented. Author

N77-26963 British Library Lending Div., Boston Spa (England).
INVESTIGATION OF PLASMA CONFINEMENT IN A DEVICE WITH A THREE-DIMENSIONAL AXIS
M. M. Dremin, A. M. Solntsev, and A. M. Stefanouskii Sep. 1976 13 p refs Transl. into ENGLISH of Russian paper IAEA-CN-3510-8-2, Oct. 1976 13 p Presented at 6th IAEA Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Berchtesgaden, 6-13 Oct. 1976
(BLL-CTO-1286-(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.

The investigation of plasma behavior in a closed trap with with a three-dimensional axis resembling a four-arc figure-eight is presented. The existence of vacuum magnetic surfaces is confirmed by numerical calculations and experiments. The results of straight-forward consideration of the diffusion coefficient in this system as a function of the collision frequency are presented. The particle life-time in a weakly ionized plasma produced by an electron beam is in satisfactory agreement with the theoretical calculations. The energy lifetime in a Joule plasma with small discharge currents is approximately equal to the value given by the empirical formula for Tokamaks. It is shown as the plasma current increases, the variation in the plasma parameters observed does not contradict the picture of increasing plasma interaction with the walls due to displacement of the column. Author

N77-26964 British Library Lending Div., Boston Spa (England).
STRONG FAST-RISING MAGNETIC FIELDS IN EXPERIMENTS ON HEATING A DENSE PLASMA IN A RAPID THETA PINCH

V. A. Burtsev, A. B. Berezin, A. P. Zhukov, V. A. Kubasov, B. V. Lyublin, V. N. Litunovskii, V. A. Ovsyannikov, A. N. Popytaev, A. V. Smirnov, V. G. Smirnov et al Sep. 1976 18 p refs Transl. into ENGLISH of Russian report IAEA-CN-35/E-17-1, Oct. 1976 18 p Presented at 6th IAEA Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Berchtesgaden, West Ger., 6-13 Oct. 1976
(BLL-CTO-1287-(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.

Results of experimental investigations on ultra-rapid heating of a dense plasma in a linear theta-pinch and switching of megampere currents in the supply system based on the application of an inductive energy accumulation method are presented. Magnetic fields of up to 50 kG with rise times of approximately 0.2 micro s were generated in a solenoid 7 cm in diameter and 50 cm long. Author

N77-26965 British Library Lending Div., Boston Spa (England).
PLASMA HEATING IN A TOROIDAL SYSTEM BY A HELICAL QUADRUPOLE RF FIELD WITH OMEGA < OMEGA SUB Bi
R. A. Demirkhanov, A. G. Kirov, S. N. Lozovskii, F. M. Nekrasov, A. G. Elfimov, S. E. Il'inskii, and V. V. Onitsenko Sep. 1976 11 p refs Transl. into ENGLISH of the Russian paper IAEA-CN-35/G 7 Presented at the 6th IAEA Conf. on Plasma Phys. and Controlled Nuclear Fusion Res., Berchtesgaden, W. Germany, 6-13 Oct. 1976
(BLL-CTO-1292-(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.

Experimental results from investigations of resonance heating on the circular two-turn stellarator R-02 over a wide range of densities, constant magnetic fields, and RF field strengths by means of a helical quadrupole RF magnetic field at frequencies of W less than W sub bi are presented. A theoretical interpretation which assumes that this phenomenon is a two-stages mechanism is given. This involves the linear resonance excitation of slightly damped natural MHD helical modes followed by the non-linear (parametric) excitation of natural volume oscillations of the plasma column. Author

N77-26966 British Library Lending Div., Boston Spa (England).
DYNAMICS OF A NON-CYLINDRICAL Z-PINCH AND THE PARTICLE ACCELERATION MECHANISM
V. V. Vikhrev, K. G. Gureev, S. K. Zhdanov, V. M. Korzhavin, and B. A. Trubnikov Sep. 1976 28 p refs Transl. into ENGLISH of Russian report IAEA-CN-35/E-18-3, Oct. 1976 28 p Presented at 6th IAEA Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Berchtesgaden, West Ger., 6-13 Oct. 1976
(BLL-CTO-1289-(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.

A model of anisotrophic hydrodynamics with magnetic viscosity is used to investigate the sausage type instability which develops against strongly turbulent surface drift waves in a noncylindrical zeta pinch. The model permits investigation of the drift instability of the zeta pinch boundary which results in turbulent diffusion and defines the length of the sausage type instability using the Bohm coefficient. As a result of the partial replacement of the conduction current, a wave in which the condition E less than or equal to B is inevitably satisfied develops and causes acceleration of both ions and electrons. Allowance for the Hall effect results in increased escape of plasma from the sausage instability. The anomalous conductivity due to transverse current instabilities gives rise to increased heating and cessation of radial plasma confinement. The neutron yield for the plasma focus is explained by a thermonuclear mechanism on the basis of a simple model for the development of the plasma focus. Author

N77-26967 British Library Lending Div., Boston Spa (England).
EQUILIBRIUM AND MHD STABILITY OF A PLASMA IN STELLARATORS WITH THREE-DIMENSIONAL AXES
L. E. Zakharov and V. D. Shafranov 1976 22 p refs Transl. into ENGLISH of the Russian paper IAEA-CN-35/D 8-1 Presented at the 6th IAEA Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Berchtesgaden, W. Germany, 6-13 Oct. 1976
(BLL-Risley-TR-1285-(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.

Certain aspects of the theory of toroidal systems with three-dimensional axes are considered. A class of simple closed curves the torsion of which has a relative curvature containing only two Fourier coefficients is defined. Relationships are obtained between these coefficients and the average torsion ensuring that the curves are closed. The equilibrium of a non-axisymmetric plasma column in the presence of a longitudinal current is considered. The confining fields which ensure equilibrium of a plasma column with an arbitrary type of axis and displacement of the plasma column with respect to the magnetic axis of the vacuum field are determined. An equation of pressure balance which relates the diamagnetic signal to the plasma pressure and current is derived for stellarator systems. Author

N77-26968 British Library Lending Div., Boston Spa (England).
INVESTIGATION OF MODEL THERMONUCLEAR SYSTEMS WITH LINERS
S. G. Alikhanov, V. P. Bakhtin, V. M. Brusnikin, I. S. Glushkov, R. Kh. Kurtmullaev, A. L. Lunin, A. D. Muzychenko, V. P. Novikov, V. V. Pichugin, V. N. Semenov et al Sep. 1976 20 p refs Transl. into ENGLISH of Russian report IAEA-CN-35/E-19-2, Oct. 1976 Presented at 6th IAEA Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Berchtesgaden, West Ger., 6-13 Oct. 1976
(BLL-CTO-1290-(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.

One of the well-established types of thermonuclear reactor is a plasma compression system using a cumulative liner. Approaches used for building this type of system are a straight Z-pinch liner compressing a magnetoactive plasma by gas kinetic pressure, and a quasi-spherical liner compressing a compact plasma formation in a closed magnetic field. Author

N77-26969 British Library Lending Div., Boston Spa (England).
THE CONTROLLED THERMONUCLEAR FUSION RESEARCH PROGRAMME IN THE USSR FOR 1976 - 1977
B. B. Kadontsev Nov. 1976 12 p Transl. into ENGLISH from Russian conference paper Presented at 6th IAEA Conf. of Plasma Phys. and Controlled Nucl. Fusion Res., Berchtesgaden, West Germany, 6-13 Oct. 1976
(BLL-CTO-1296-(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.

Advances in Soviet controlled fusion research, and associated engineering and technical problems are discussed. Areas investigated include steady state systems, pulsed systems including laser fusion, and high temperature plasma physics.
A.R.H.

N77-26970 British Library Lending Div., Boston Spa (England).
INERTIAL CONFINEMENT: A SUMMARY TALK
O. N. Krokhin Nov. 1976 9 p Transl. into ENGLISH of report from West German conf. Presented at 6th IAEA Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Berchtesgaden, West Germany, 6-13 Oct. 1976
(BLL-CTO-1300-(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.

The following aspects of inertial confinent are considered: (1) interaction of laser radiation with a plasma, including absorption and reflection, generation of fast electrons and ions, and anomalies in the energy transport processes in a plasma; (2) results on the compression of D-T filled microspheres; and (3) results obtained using electron beams in inertial confinement systems. Author

N77-26971 British Library Lending Div., Boston Spa (England).
SPECTROSCOPIC INVESTIGATIONS OF ADIABATIC COMPRESSION IN A TOKAMAK
M. G. Kaganskii, S. G. Kalmykov, S. V. Lebedev, and K. G. Shakhovets Sep. 1976 20 p Transl. into ENGLISH of conf. paper from Ioffe Physico-Tech. Inst., Acad. Sci. USSR, Leningrad Presented at 6th IAEA Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Berchtesgaden, West Germany, 6-13 Oct. 1976 as IAEA-CN-35/A-12
(BLL-CTO-1282-(9091.9F); IAEA-CN-35/A-12) Avail: British Library Lending Div., Boston Spa, Engl.

The line radiation of impurity ions in the visible and ultraviolet regions was measured during adiabatic compression of a plasma in the Tuman-2 Tokamak. This enabled the radial distribution of the electron temperature to be determined. The marked asymmetry of this distribution along the major radius in the compressed plasma column is due to outward displacement of

the magnetic surfaces. The maxium electron temperature in the compressed plasma, approximately 400 eV, is 1.7 times greater than that calculated assuming purely adiabatic heating. This indicates that the heat insulation of the plasma is improved. The energy lifetime increases from 150 microsecond ohmic heating to 800 microsecond in the compressed plasma. Spectroscopic measurements also show that the flux of light impurities penetrating the plasma is halved during compression. Author

N77-26972 British Library Lending Div., Boston Spa (England).
THE KINETICS OF NEUTRALS PRODUCED DURING THE INJECTION OF AN ATOM BEAM INTO THE PLASMA
A. S. Kukushkin, V. I. Distunovich, and S. V. Putvinskii Sep. 1976 19 p refs Transl. into ENGLISH of conf. paper from Kurchatov Inst. of Atomic Energy, Moscow Presented at 6th IAEA Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Berchtesgaden, West Germany, 6-13 Oct. 1976 as IAEA-CN-35/B-4
(BLL-CTO-1284-(9091.9F); IAEA-CN-35/B-4) Avail: British Library Lending Div., Boston Spa, Engl.

The behavior of charge exchange neutrals produced in a Tokamak plasma during the injection of an atom beam was modeled using the Monte Carlo method. Steady state conditions for the injection of a neutral beam into a toroidal plasma were considered. The kinetics of the neutrals were determined by averaging over a large number of individual trajectories which were calculated using a random number generator. Allowance was made for resonant charge exchange with plasma ions, ionization by electrons, and ionization of neutrals by plasma ions. The calculations were performed for the injection of neutral deuterium into a deuterium plasma with parameters comparable to those of a reactor. The following characteristics were obtained for different injection energies: (1) radial distribution of average fast ion density; (2) radial distribution of average charge exchange neutral density; (3) energy spectrum of charge exchange neutrals both inside the plasma and escaping to the walls; (4) proportion of beam particles and energy transferred to the walls by the neutrals and (5) distribution of escaping neutral over the walls. Author

N77-26973 British Library Lending Div., Boston Spa (England).
THE INITIAL STAGE OF DISCHARGE DEVELOPMENT IN TOKAMAKS
V. A. Abramov, V. V. Vikhrev, and O. P. Pogutse Sep. 1976 16 p refs Transl. into ENGLISH of Russian Report IAEA-CN-35/A-14-2 Presented at 6th IAEA Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Berchtesgaden, West Ger., 6-13 Oct. 1976
(BLL-CTO-1283-(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.

The results of analysis and numerical calculations of equations describing discharge development in toroidal systems with a strong longitudinal field are presented. The results of numerical integration of the following system of equations describing gas breakdown in Tokamaks are given: (1) the equation of continuity for the electrons with allowance for ionization and diffusion, (2) the equation for the average electron energy (temperature) with allowance for thermal conductivity, ionization and radiation, (3) the electrodynamic equation describing the skin effect for the electric field. Author

N77-26974 British Library Lending Div., Boston Spa (England).
IONIZATION INSTABILITY OF A NON-SELF-SUSTAINING DISCHARGE DUE TO STEP IONIZATION
S. A. Golubev, A. S. Kovalev, V. D. Pismennyi, A. T. Rakhimov, and T. V. Rakhimova Sep. 1976 9 p refs Transl. into ENGLISH from Akad. Nauk SSSR Doklady (Moscow), v. 228, no. 1, 1976 p 77-80
(BLL-CTO-1267-(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.

Ionization instability in non self-sustaining gaseous discharges may develop because of the population of metastable electron levels of molecules during the discharge process, increase in the importance of step ionization, and consequent transition of the gaseous discharge to self-sustaining burning conditions. Electron/ion recombination in mixtures of N2-CO2-He2-O2 gases is analyzed. A method is described for using a non self-sustaining discharge in which the excitation zones (zones through which the current is passing) alternate in the direction of gas flow with zones in which no gas discharge current flows. Excited molecules accumulating are relaxed during passage of the gas between two successive excitation zones. The limiting characteristics of the discharge would be restricted by the development of thermal instability. This can be achieved by transition of the gaseous discharge from stationary burning conditions to repeated pulse conditions, and by selecting appropriate frequencies and energy inputs for each pulse. A.R.H.

N77-26975 British Library Lending Div., Boston Spa (England).
ACCELERATED ELECTRON BEAM INSTABILITY IN TOKAMAKS
V. V. Parail and O. P. Pogutse Sep. 1976 15 p refs Transl. into ENGLISH from Fiz. Plazmy (USSR), v. 2, no. 2, 1976 p 228-236
(BLL-CTO-1262-(9091.9F)) Copyright. Avail: British Library Lending Div., Boston Spa, Engl.

A theory is presented which appears to explain the main experimental observations made during the development of kinetic instability in a low density plasma or to be more precise, when the condition omega sub He > omega sub pe is fulfilled (i.e. H > square rot of 4 pi sub mc squared), where nsubo is the plasma density, H sub o is the longitudinal magnetic field strength and m is the electron mass). It should be noted that in the case under consideration, the anomalous Doppler effect plays an important part in the process of electron scattering by oscillations, causing this scattering to assum a virtually elastic form when the inequality omega sub He > omega sub pe > omega is fulfilled. Author

N77-26976# Princeton Univ., N. J. Plasma Physics Lab.
LOWER HYBRID PARAMETRIC INSTABILITIES NONUNIFORM PUMP WAVES AND TOKAMAK APPLICATIONS
R. L. Berger, Liu Chen, P. K. Kaw, and F. W. Perkins Nov. 1976 54 p refs
(Contract E(11-1)-3073)
(PPPL-1308) Avail: NTIS HC A04/MF A01

Electrostatic lower hybrid pump waves often launched into Tokamak plasmas by structures (e.g., waveguides) whose dimensions are considerably smaller than characteristic plasma sizes. Such waves propagate in well-defined resonance cones and give rise to parametric instabilities driven by electron E x B velocities. The finite size of the resonance cone region determines the threshold for both convective quasimode decay instabilities and absolute instabilities. The excitation of absolute instabilities depends on whether a traveling or standing wave pump model is used; traveling wave pumps require the daughter waves to have a definite frequency shift. Altogether, parametric instabilities driven by E x B velocities occur for threshold fields significantly below the threshold for filamentation instabilities driven by pondermotive forces. Applications to Tokamak heating show that nonlinear effects set in when a certain power-per-wave-launching port is exceeded. ERA

N77-26977# Bechtel Corp., San Francisco, Calif.
EVALUATION OF THE TECHNICAL AND ECONOMIC FEASIBILITY OF MIRROR FUSION DEVICES Final Report
Aug. 1976 191 p refs
(Contract W-7405-eng-48)
(UCRL-13695) Avail: NTIS HC A09/MF A01

The following four task-reports are included: (1) cost analysis of potassium vapor topping cycle and conventional steam cycle, (2) heat transport and energy conversion system analysis and conceptual cost estimate, (3) plant arrangement, and reactor containment structural design and cost estimate, and (4) coil restraint structure conceptual design and cost estimate. Each of the reports is complete in itself with respect to the particular task concerned. ERA

N77-26978# Princeton Univ., N. J. Plasma Physics Lab.
STATUS OF TOKAMAK PLASMA PHYSICS
M. B. Gottlieb Nov. 1976 15 p refs Presented at 2d Topical Meeting on the Technol. of Controlled Nucl. Fusion, Richland, Wash., 21 Sep. 1976
(Contract E(11-1)-3073)
(PPPL-1296; Conf-760935-36) Avail: NTIS HC A02/MF A01

The performance of Tokamak plasmas is reviewed and

compared with reactor requirements. Energy confinement time increases with plasma density and radius. The ion temperature has been raised to almost 2 keV by intense neutral beam injection. Effective methods for impurity control, plasma fueling, and exhaust must still be developed for long-pulse operation. The maximization of fusion power density required for an economic Tokamak reactor seems attainable by a combination of moderately high magnetic field and one or more beta enhancement schemes such as the use of a noncircular plasma cross section. ERA

N77-26979# Energy Research and Development Administration, Washington, D.C.

CURRENT HEATING OF PLASMA IN THE L-2 STELLARATOR

D. K. Akulina, E. D. Andryukhina, M. S. Berezhetskii, M. A. Blokh, G. S. Voronov, S. Ye. Grebenshchikov, I. S. Danilkin, N. M. Zverev, M. A. Ivanovskiy, and Yu. I. Nechayev 1976 13 p refs Transl. into ENGLISH from Russian report Presented at the 6th Intern. Conf. on Plasma Physics and Controlled Nuclear Fusion Research, Berchtesgaden, W. Germany, 6 Oct. 1976
(CONF-761012-29) Avail: NTIS HC A02/MF A01

The first experiments on the L-2 stellarator, are discussed. The L-2 stellarator consists of a toroidal magnetic trap with a double (1 = 2) helical field. The major diameter of the torus D = 200 cm, and the cross sectional diameter of the vacuum chamber d = 35 cm. The maximum magnetic field B(o) = 20 KG (in the experiments under consideration, B(o) less than or equal to 14 (KG). The rotational transform angle on axis Z/sub delta/(o) - 0.2, on the boundary surface Z/sub delta/(a) = 0.7, and the shear theta approximately equal to 0.5. The mean radius of the boundary magnetic surface anti a = 11.5 cm. ERA

N77-26980*# National Center for Atmospheric Research, Boulder, Colo.

DISSIPATIVE, FORCED TURBULENCE IN TWO-DIMENSIONAL MAGNETOHYDRODYNAMICS

David Fyfe, David Montgomery, and Glenn Joyce (Iowa Univ., Iowa City) 1976 71 p refs
(Grant NGL-16-001-043; Contract E(11-1)-2059)
(NASA-CR-152862; COO-2059-55) Avail: NTIS HC A04/MF A01 CSCL 20I

The equations of motion for turbulent two-dimensional magnetohydrodynamic flows are solved in the presence of finite viscosity and resistivity, for the case in which external forces (mechanical and/or magnetic) act on the fluid. The goal is to verify the existence of a magnetohydrodynamic dynamo effect which is represented mathematically by a substantial back-transfer of mean square vector potential to the longest allowed Fourier wavelengths. External forces consisting of a random part plus a fraction of the value at the previous time step are employed, after the manner of Lilly for the Navier-Stokes case. The regime explored is that for which the mechanical and magnetic Reynolds numbers are in the region of 100 to 1000. The conclusions are that mechanical forcing terms alone cannot lead to dynamo action, but that dynamo action can result from either magnetic forcing terms or from both mechanical and magnetic forcing terms simultaneously. GRA

N77-26981# General Atomic Co., San Diego, Calif.

CONCEPTUAL DESIGN STUDY OF A NONCIRCULAR TOKAMAK DEMONSTRATION FUSION POWER REACTOR

Nov. 1976 256 p refs
(Contract E(04-3)-0167; Proj. 38)
(GA-A-13992) Avail: NTIS HC A12/MF A01

Design Studies were carried out to examine alternatives and to critically evaluate selected key technological problems in the initial conceptual design of a Doublet Tokamak demonstration plant. The major objectives of this plant are to demonstrate the features of a commercial plant which is safe, reliable, and environmentally acceptable. It is particularly important that the plant demonstrate tritium breeding with a breeding ratio greater than or equal to 1 and that it provide the basis for both technological and economic scaling to commercial operation. To accomplish this, parametric systems analyses of various commercial plant configurations were carried out. Alternative solutions were investigated for the maintenance procedures, breeder material, coolant, shielding, and F-coil system. Based on these evaluations, a design study was carried out to establish an initial conceptual design of a demonstration power reactor. ERA

N77-26982# Los Alamos Scientific Lab., N. Mex.

HOT ELECTRON PRODUCTION, ANOMALOUS ABSORPTION, AND EFFECT OF INTENSE ELECTROMAGNETIC FIELDS ON INVERSE BREMSSTRAHLUNG ABSORPTION NEAR THE ELECTRON PLASMA FREQUENCY

J. H. Brownell, H. Dreicer, R. F. Ellis, and J. C. Ingraham 1976 16 p refs Presented at the 3d Symp. on Plasma Heating in Toroidal Devices, Varenna, Italy, 6-17 Sep. 1976
(Contract W-7405-eng-36)
(LA-UR-76-1951; Conf-760958-7) Avail: NTIS HC A02/MF A01

Anomalous heating was studied on a well-controlled low-density plasma subjected to short microwave pulses. Absorption measurements along with parametric instabilities are described. The influence of intense ac electric fields on the electron-ion collision rate in the plasma is also discussed. Author (ERA)

N77-26983# California Univ., Livermore. Lawrence Livermore Lab.

MEASUREMENT OF THE WIDTHS OF EMISSION LINES FROM LASER PRODUCED PLASMAS

L. M. Richards, V. W. Slivinsky, J. D. Eckels, and S. S. Glaros 15 Sep. 1976 28 p refs Presented at the Plasma Phys. Meeting of the Am. Phys. Soc., San Francisco, 15-19 Nov. 1976
(Contract W-7405-eng-48)
(UCRL-78446; Conf-761108-8) Avail: NTIS HC A03/MF A01

The targets used for the creation of laser produced plasmas often contain sodium, silicon and other period 3 elements. Temperature and density information can be inferred from detailed study of the characteristic radiation from these elements. The resolution capabilities of crystal spectrographs designed to look at such target radiation are discussed. Data from several types of spectrographs are compared. The fine structure of the hydrogen and helium-like silicon lines are used to illustrate spectrograph resolution. A spectrograph for examining weak characteristic radiation near 1 keV due to plasma which has been compressed with a spherical irradiation system is discussed. ERA

N77-26984# Argonne National Lab., Ill.

IMPURITY CONTROL IN NEAR-TERM TOKAMAK REACTORS

Weston M. Stacey, Jr., Dale L. Smith, and Jeffrey N. Brooks Oct. 1976 20 p refs Presented at the 2d Topical Meeting on the Technol. of Controlled Nucl. Fusion, Richland, Wash., 21-23 Sep. 1976
(Contract W-31-109-eng-38)
(CONF-760935-48) Avail: NTIS HC A02/MF A01

Several methods for reducing impurity contamination in near-term Tokamak reactors by modifying the first wall surface with a low-Z or low-sputter material are examined. A review of the sputtering data and an assessment of the technological feasibility of various wall modification schemes are presented. The power performance of a near-term Tokamak reactor is simulated for various first wall surface materials, with and without a divertor, in order to evaluate the likely effect of plasma contamination associated with these surface materials. ERA

N77-26985# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).

[EXPERIMENTAL AND THEORETICAL WORK IN PLASMA PHYSICS] Annual Status Report, 31 Dec. 1975

Jun. 1976 92 p refs Sponsored by Neth. Organ. for Pure Sci. Res. (ZWO) and Euratom
Avail: NTIS HC A06/MF A01

Experimental topics discussed are the high-beta experiment SPICA, turbulent plasma heating, and gas blanket research. Theoretical topics concern Tokamak and screw-pinch configurations, as well as transport theory. ESA

N77-26986# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.

EXPERIMENTS WITH A LARGE SIZED HOLLOW CATHODE DISCHARGE, PART 3 Final Report, Jan. 1975 - Jun. 1976

F. Boeschoten, D. J. Kleijn, R. Komen, A. F. C. Sens, and A. W. M. Vanlersel Nov. 1976 42 p refs Sponsored by Euratom
(TH-76-E-67; ISBN-90-6144-067-X) Avail: NTIS HC A03/MF A01

Investigations of a large sized hollow cathode discharge are reported noting especially the positive column. Operation of the arc with gases other than argon is treated. Special ways of operation of the arc, which are of particular interest for potential mass separative properties of the arc are described. A possible origin of the mass rotation and the energy transport are discussed. Author (ESA)

N77-26987# Colorado Univ., Boulder.
APPLIED RESEARCH IN THE GENERAL AREA OF CHARGED PARTICLE CHEMISTRY RELATED TO COAL-FIRED MHD Progress Report, 1 Nov. 1975 - 30 Apr. 1976
D. W. Norcross, W. C. Lineberger, and E. C. Beaty 1976 117 p refs
(Grant NSF AER-74-20552)
(PB-263873/2; NSF/RA-760444) Avail: NTIS HC A06/MF A01 CSCL 07A

The three major components of the present program are measurement of the thermodynamic properties of some of the most important negative ions, development and application of theoretical techniques to the determination of the contribution to the plasma conductivity of the dominant polar molecules, and the provision of a comprehensive compilation of data on molecular electron affinities and on electron collisions with atomic and molecular species peculiar to the MHD plasma. GRA

N77-26988# Argonne National Lab., Ill. Engineering Div.
EXPERIMENTAL TWO-PHASE LIQUID-METAL MAGNETOHYDRODYNAMIC GENERATOR PROGRAM Annual Report, Aug. 1974 - Jul. 1975
M. Petrick, G. Fabris, R. Cole, R. Hantman, E. Pierson, and J. Cutting Nov. 1976 105 p refs
(Contract NAonr-16-76)
(AD-A035245; ANL-ENG-76-04) Avail: NTIS HC A06/MF A01 CSCL 10/2

A new diverging-channel liquid-metal MHD generator with gas injection along the insulating walls was built and placed in operation in late 1974. This generator yielded nearly-constant liquid velocity along the channel for near-design conditions, as desired for best performance. Extensive measurements of the generator terminal and internal parameters were made over a range of gas and liquid flow rates, magnetic field strengths, and load resistance values. Data are given for generator efficiency and load voltages, and the variations along the channel of liquid and gas velocities, pressure, local load factor, void fraction, and slip ratio. Comparisons are made with theoretical predictions. Tests made to evaluate the effectiveness of the gas injection indicated that the generator performance improved slightly as the amount of gas injected was decreased, and that the injected gas was not forming the desired pure-gas wall layer. Following this, air-water tests indicated that this was to be expected, and a one-dimensional computer model indicated that performance should be better without the partial flow obstruction of the gas injection ports. The gas injection ports were removed, and substantial improvement was obtained in generator performance - by far the best to date. Data comparable to that for gas injection is presented for this case. The future directions of the program, including the role of gas injection, and the modifications to the NaK-nitrogen facility are described. Author (GRA)

N77-26989# Naval Research Lab., Washington, D. C.
MARGINAL STABILITY ANALYSIS: A SIMPLER APPROACH TO ANOMALOUS TRANSPORT IN PLASMAS
J. P. Boris and Wallace Manheimer Feb. 1977 21 p refs Sponsored by ERDA
(NRL Proj. H02-37)
(AD-A036916; NRL-MR-3445) Avail: NTIS HC A02/MF A01 CSCL 20/9

It is shown that an unstable plasma evolves toward a marginally stable state. From the knowledge that the plasma is marginally stable, one can calculate profiles, transport coefficients and turbulence levels quite accurately. Author (GRA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N77-26990# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
SURFACE STUDY OF SEMICONDUCTOR DEVICES Final Report, 1 Jan. 1975 - 31 Dec. 1976
R. W. Grant 6 Mar. 1977 46 p refs
(Contract N00014-75-C-0344)
(AD-A037502; SC5016.7FR) Avail: NTIS HC A03/MF A01 CSCL 20/12

ESCA studies of Pb(1-x)Sn(x)Te and a few InAs(1-X)Sb(x) surfaces are reported. A diode array structure has been developed to facilitate the correlation of surface composition and surface leakage currents. ESCA results establish that elemental tellurium layers form on several semiconductor tellurides. It is shown that these tellurium layers on Pb(1-x)Sn(x)Te diodes produce exceptionally low surface leakage currents at 77 K which suggests that elemental Te may be a surface passivant for Pb(1-x)Sn(x)Te. Author (GRA)

N77-26991# Battelle Pacific Northwest Labs., Richland, Wash.
APPLICATION OF ROBUST/RESISTANT TECHNIQUES TO CRYSTAL STRUCTURE REFINEMENT
W. L. Nicholson and E. Prince Aug. 1976 6 p refs
(Contract E(45-1)-1830)
(BNWL-SA-5936) Avail: NTIS HC A02/MF A01

The least squares technique commonly used for refining crystal structures is neither robust (min variance with errors in experimental data) nor resistant (not highly dependent on any small subset of data). Other methods of fitting are being developed which are more robust/resistant, and these methods were applied to crystal structure refinement. The Tukey biweight W-function succeeds in minimizing the influence of poor data. ERA

N77-26992# California Univ., Berkeley. Lawrence Berkeley Lab.
ELECTRONIC STRUCTURE OF METALS AND SEMICONDUCTORS: BULK, SURFACE, AND INTERFACE PROPERTIES Ph.D. Thesis
S. G. S. Louie Sep. 1976 265 p refs
(Contract W-7405-eng-48)
(LBL-5493) Avail: NTIS HC A12/MF A01

A theoretical study of the electronic structure of various metals and semiconductors is presented with the emphasis on understanding the properties of these materials when they are subjected to extreme conditions and in various different configurations. Among the bulk systems studied, the properties of cesium under high pressure are discussed in terms of the electronic structure calculated at various cell volumes using the pseudopotential method. Local fields or umklapp processes in semiconductors are studied within the random phase approximation (RPA). Specifically the dielectric response matrix epsilon/sub GG'/(q = 0, omega) is evaluated numerically to determine the effects of local-field corrections in the optical spectrum of Si. Also, some comments on the excitonic mechanism of superconductivity are presented and the role of local fields is discussed. ERA

N77-26993# California Univ., Berkeley. Lawrence Berkeley Lab.
RESONANT RAMAN SCATTERING IN GaSe AND GaS(x)Se (1-x)
T. C. Chiang, J. Camassel, J. P. Voitchovsky, and Y. R. Shen Jul. 1976 14 p refs Presented at Conf. on Liquid Semicond. and Metals, Bari, Italy, 6 Sep. 1976
(Contract W-7405-eng-48)
(LBL-5456; Conf-760948-2) Avail: NTIS HC A02/MF A01

Multiphonon resonant Raman scattering up to four phonons in GaSe and one and two phonon resonant Raman scattering in the mixed GaS/sub x/Se/sub 1-x/ crystals with x less than or equal to 0.23 were investigated. The results can be explained by a simple theory in which the dispersion of the resonance behavior is mainly dominated by resonances with the ls direct exciton state. GRA

N77-26994# California Univ., Berkeley. Lawrence Berkeley Lab.
OPTICAL PROPERTIES OF LAYER COMPOUNDS Ga S SUB X Se SUB 1-X
J. Camassel, M. Schluter, S. Kohn, J. P. Voitchovsky,. Y. R. Shen, and M. L. Cohen May 1976 7 p refs Presented at 13th Intern. Conf. on Phys. of Semicond., Rome, 30 Aug. 1976
(Contract W-7405-eng-48)
(LBL-5464; Conf-760860-1) Avail: NTIS HC A02/MF A01

The reflectivity and wavelength modulated reflectivity of Ga S/sub x/Se/sub 1-x/ mixed crystals were investigatad at 5 K for energies ranging from 3 to 6 eV. The main structures in the optical response function of the alloy spectra are found to exhibit three characteristic classes of shift versus composition. These results are discussed on the basis of a new, slightly modified, pseudopotential band structure calculation for GaSe. The anisotropic and excitonic character of the 3.4 eV structure in GaSe is also discussed in light of the band structure calculation. ERA

N77-26995# Sandia Labs., Albuquerque, N. Mex.
CATHODOLUMINESCENCE STUDIES OF THE 1.4 eV BANDS IN CdTe
C. B. Norris and C. E. Barnes 1976 27 p refs Presented at 2d Intern. Symp. on Cadmium Telluride, Phys. Properties and Appl., Strasbourg, France, 29 Jun. 1976
(Contract E(29-1)-789)
(SAND-76-5472; Conf-760686-1) Avail: NTIS HC A03/MF A01

Combined measurements were made of injection level dependence, transition response and thermal quenching. The 1.4 eV luminescence has the following characteristics: (1) the band shape and peak position are independent of injection level, except for those samples having overlapping bands, (2) the transition is slow, with characteristic times on the order of 1-5E-6 s, (3) the transition response time is approximately constant over three orders of magnitude in doping level, (4) the luminescence intensity increases with donor doping level, and (5) the luminescence shows thermal quenching with a relatively large activation energy. ERA

N77-26996# Utah Univ., Salt Lake City. Dept. of Materials Science and Engineering.
IMPURITY EFFECTS ON THE CREEP OF POLYCRYSTALLINE MAGNESIUM AND ALUMINUM OXIDES AT ELEVATED TEMPERATURES Technical Progress Report, Dec. 1975 - 18 Dec. 1976
R. S. Gordon Dec. 1976 23 p refs
(Contract EY-76-S-02-1591)
(COO-1591-31) Avail: NTIS HC A02/MF A01

Three well defined regimes were identified for the diffusional creep of polycrystalline MgO and Al2O3, pure and doped with transition metal impurities: cation grain boundary diffusion, cation lattice diffusion, and anion grain boundary diffusion. Creep deformation maps have been developed for ambipolar diffusional creep and applied to pure and doped MgO and Al2O3. Iron in solid solution enhances grain boundary diffusivities (cation and anion) in polycrystalline MgO in addition to magnesium lattice diffusion via the creation of cation lattice vacancies. Residual fluorine in polycrystalline MgO leads to enhanced magnesium lattice and grain boundary diffusivities and hence to increased diffusional creep and grain growth rates. Viscous Coble (diffusional) creep, which is rate-limited by oxygen grain boundary diffusion, has been identified in reduced iron-doped (2 cation percent) and double-doped (1/4 percent Mn and 1/4 percent Ti) polycrystalline Al2O3. ERA

N77-26997# Brookhaven National Lab., Upton, N.Y.
THIN FILMS
M. Strongin and D. L. Miller 1976 28 p refs
(Contract EY-76-C-02-0016)
(BNL-21964) Avail: NTIS HC A03/MF A01

The phenomena are reviewed that occur in films from the point of view of a solid state physicist. Films form the basis for many established and developing technologies. Metal layers have always been important for optical coatings and as protective coatings. In the most sophisticated cases, films and their interaction on silicon surfaces form the basis of modern electronic technology. Films of silicon, GaAs and composites of these materials promise to lead to practical photovoltaic devices. ERA

N77-26998# Airco, Inc., Murray Hill, N. J. Central Research Labs.
RESEARCH AND DEVELOPMENT EFFORTS RELATIVE TO SUPERCONDUCTING MATERIALS Final Report
E. Adam, P. Beishcher, W. Marancik, R. Lucariello, and M. Young Apr. 1976 100 p
(Contract E(11-1)-2551)
(CONS/2551-1) Avail: NTIS HC A05/MF A01

Long lengths of Nb3Sn tapes were prepared by the rolled bronze process from extruded and rolled bronze-clad niobium billets. Tapes were stabilized by removing the bronze layer after reaction and then coating the exposed Nb3Sn with high purity copper by EB evaporation. Several meters of high quality NbSn tapes were produced by the rolled bronze process. Even when the tapes were stabilized with copper, the losses were as low as 1.8 micron W/sq cm at 4.2 K and a surface current density of 500 rms A/cm. Despite early curtailment of the effort on the EB bronze-deposition process, short samples of Nb3SN tapes were produced. ERA

N77-26999# Airco, Inc., Murray Hill, N. J. Central Research Labs.
COMPARATIVE COST STUDY OF THE PROCESSES FOR PRODUCING NIOBIUM-TIN (Nb3 Sn) SUPERCONDUCTING TAPES FOR THEIR APPLICATION TO POWER TRANSMISSION LINES Final Report
Oct. 1976 106 p
(Contract PO-WA-76-4939)
(ERDA-76-160) Avail: NTIS HC A06/MF A01

The 14 product examples studied are produced by processes involving solid-state diffusion of Sn and Nb and/or physical vapor deposition. Production of 80,000 km per year is assumed, sufficient for 100 km of 3 phase ac line. Results are summarized in a table. The table identifies the 14 product examples by method of manufacture, by the composition of the layers integrated into the tape, and by the final thickness of Nb used in 12 of the product examples. The estimated fixed capital per plant is listed for each product example together with the estimated costs of manufacture in cents per meter of tape. The total manufacturing cost given is the sum of the costs of raw materials, operating labor, depreciation, and other overhead. ERA

N77-27000# Oak Ridge National Lab., Tenn.
POINT DEFECT INTERACTIONS AND GROWTH OF DISLOCATION LOOPS
M. H. Yoo and J. O. Stiegler 1976 9 p refs Presented at the Intern. Conf. on Properties on Atomic Defects on Metals, Argonne, Ill., 18 Oct. 1976
(Contract W-7405-eng-26)
(CONF-761027-7) Avail: NTIS HC A02/MF A01

A direct method of determining the effective measure of the interaction of point defects with dislocation loops is proposed. A system of partial differential rate equations for loop growth is formulated and is solved by a numerical method. An in-situ HVEM irradiation experiment was conducted to study growth kinetics of dislocation loops in Ni at 450 C. It is found from systematic variations of the vacancy migration energy, E/sub v/sup m/, and the preference factor of dislocation loops for self-interstitials, delta/sub i/, that delta/sub i/ = 0.06 and E/sub v//sup m/ = 1.2 eV together yield reasonable agreement between the theoretical model and the experimental observations. ERA

N77-27001# Xonics, Inc., Van Nuys, Calif.
RESEARCH ON CRYSTAL CHEMISTRY STUDIES Final Report, 28 Mar. 1975 - 30 Jun. 1976
M. Sparks and C. J. Duthler Griffiss AFB, N. Y. RADC 30 Nov. 1976 160 p refs
(Contract F19628-75-C-0123)
(AD-A035478; RADC-TR-76-343) Avail: NTIS HC A08/MF A01 CSCL 07/4

This research program is presently concerned with scattering from dispersed metallic spheres that have been coated with a passive layer to reduce cohesion and to prevent excessive material degration. Various mechanisms for the cohesion of spheres are

investigated and the conditions under which particular mechanisms become dominant are determined. Using the Lenard-Jones potential as a mathematically convenient model potential for the molecular attraction of spheres, the thickness of a molecular-solid coating required to saturate the molecular binding from strong metallic binding to relatively weak van der Waals binding is estimated. The theory of light scattering from coated spheres is investigated. The qualitative relationship between actual metallic spheres and perfectly conducting is explored along with the qualitative similarity of coated metallic spheres and perfectly conducting spheres. Quantitative effects of nondispersive, absorbing, and nonabsorbing coatings of various thickness are determined. In the final part of this section, Lorentzian absorption lines of various linewidths are used as models for absorption and dispersion in actual coatings. A listing of the computer program for calculating the scattering from coated spheres and description of the subroutines are given in the appendices GRA

N77-27002# Rome Air Development Center, Griffiss AFB, N.Y.
SYNTHESIS OF INDIUM PHOSPHIDE
N. Klausutis, J. Adamski, and J. Sampson Sep. 1976 15 p refs
(AF Proj. 5620)
(AD-A035507; RADC-TR-76-305) Avail: NTIS HC A02/MF A01 CSCL 07/2

Indium phosphide is a compound of great interest both as a III-V semiconductor and as a substrate material for epitaxy. It is a difficult material to synthesize with sufficient purity. Techniques reported here appear to have solved the synthesis problem, and have produced high-purity material in sufficient quantity for the growth of single crystals. They may also be applicable to the synthesis of other III-V compounds. There remains a problem that must be solved before the method is considered reliable, explosions occasionally occur during product cooling. GRA

N77-27003# Georgetown Univ., Washington, D.C.
THERMODYNAMICS AND STATISTICAL MECHANICS OF LIQUID CRYSTALS AND THEIR SOLUTIONS Final Report, 1Sep. 1966 - 31 Dec. 1976
Daniel E. Martire 1977 6 p refs
(Grants DA-ARO-D(31)-124-G817; DA-ARO(D)-31-1224-G1167)
(AD-A037105) Avail: NTIS HC A02/MF A01 CSCL 07/4

This is a brief summary of the liquid crystal research supported by ARO at Georgetown University during the past ten years. Research has been directed toward a more detailed understanding, on a molecular level, of the thermodynamic properties of (a) phase transitions in liquid crystals and (b) binary mixtures of nonmesomorphic solutes and nematic (or cholesteric) solvents.
Author (GRA)

N77-27004# National Bureau of Standards, Washington, D. C. Inst. for Materials Research.
PIEZOELECTRICITY AND PYROELECTRICITY IN CRYSTALLINE POLYMERS Technical Report, 1 Jan. - 31 Dec. 1976
G. Thomas Davis and M. G. Broadhurst Dec. 1976 58 p refs
(Contracts N00014-76-F-0004; NAonr-20-75)
(AD-A037606; NBSIR-76-1186; TR-4) Avail: NTIS HC A04/MF A01 CSCL 07/3

Investigations on piezoelectricity and pyroelectricity in crystalline polymers have been carried out using a copolymer of vinylidene fluoride and tetrafluoroethylene which crystalliezes directly from the melt into a polar crystal form. The crystalline fraction is easily varied from 0.35 to 0.5. Alignment of the dipoles in an applied electric field appears to approach saturation electric fields of 250 kV/cm, independent of poling temperatures between 0 and 80 C. Piezoelectric responses from samples of varying crystallinity are consistent with increased polarization and lower compressibility as the degree of crystallinity is increased. Thermal pulse experiments reveal that when poled at room temperature, only a thin region near the positive electrode is poled but the thickness of this region increases with an increase in poling temperature. Copolymer films crystallized from the melt in the presense of a field show greatly improveed stability of piezoelectric activity when stored at elevated temperatures compared with samples poled only after crystallization. The room temperature poling of polyvinylidene fluoride using a corona discharge has been confirmed. Preliminary results are presented which imply that even the non-polar alpha phase of the polymer may be poled in this way but it is unstable--especially at elevated temperatures. Author (GRA)

N77-27005# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.
LOW-FREQUENCY NOISE IN (HG, CD) TE DETECTORS Final Report, 1 Apr. 1974 - 30 Jun. 1976
Hussein Ibrahim Hanafi and Aldert VanderZiel Oct. 1976 146 p refs
(Contract F33615-74-C-5104)
(AD-A037185; AFML-TR-76-175) Avail: NTIS HC A07/MF A01 CSCL 17/5

The purpose of this study was to identify and understand the sources of 1/f noise in n-type HgCd Te detectors and to recommend methods for reducing this noise. Four items were investigated: (a) Noise generated at noisy contacts. This could be interpreted as injection 1/f noise. (b) Noise at grain boundaries. We found devices with grain boundaries to be noisier than those without it; in our geometry the difference was a factor 4. (c) Noise generated at the surface versus bulk noise. We found the noise to be more variable from sample to sample than bulk noise permits. We also showed by a direct experiment (MIS devices) that the flicker noise was surface generated. (d) A modulation technique was developed for discriminating between noise sources, but was not used in the experiments under (c). Author (GRA)

N77-27006# Rome Air Development Center, Griffiss AFB, N.Y.
ELECTRON MICROSCOPE STUDY OF DEFECTS IN ANNEALED BORON IMPLANTED SILICON Interim Report
Joseph J. Comer and Sven A. Roosilo Dec. 1976 25 p refs
(AF Proj. 2306)
(AD-A037956; RADC-TR-76-398) Avail: NTIS HC A02/MF A01 CSCL 20/12

Transmission electron microscopy was used to characterize defects observed in silicon, following boron implantation through an oxide film and annealing in nitrogen or argon to 950 C. Rod defects, believed by some to be boron precipitates, are formed upon annealing from 600 to 700 C. Most of these defects disappear upon annealing to 950 C when maximum electrical activity is achieved. At this point, most of the defects consist of narrow dislocation dipoles or loops. In this study, we observed at 950 C rows of closely spaced loops similar in diameter and in length to the rod defects. This led us to the belief that they were derived directly by the dissolution of the rod defects. Small precipitate particles were sometimes attached to the single loops. Contrast within some of the residual rod defects suggested partial dissolution. These observations can be explained by assuming that the rod defects are rows of boron atoms which, upon dissolution, leave a narrow dipole or loop which may pinch off into smaller loops forming rows of the type observed. Loop formation can be explained by the mechanism suggested by Bicknell where, as the boron atoms of which the rods are composed move into substitutional positions, interstitial silicon atoms are formed. These coalesce to form dipolar loops which may pinch off into loop rows. A small percentage of the boron atoms may form silicon borides at the sites of dislocation loops. GRA

N77-27007*# Colorado State Univ., Fort Collins. Dept. of Physics.
OXIDE BARRIERS ON A GaAs BY NEUTRALIZED ION BEAM SPUTTERING
L. G. Meiners, R. C. Pan, and J. R. Sites 10 Feb. 1977 17 p refs
(Grant NsG-3086; Contract N00014-76-C-0976)
(NASA-CR-152866; AD-A037243; SF9) Avail: NTIS MF A01/HC A02 CSCL 20L

Tantalum and silicon oxides have been sputter deposited onto gallium arsenide using a 500 eV beam of neutralized argon atoms. MIS devices show very low leakage and capacitances that can be varied from full accumulation to depletion with the application of modest voltages. Other measurements (breakdown field, dielectric constant, adherence, Auger profile, and photoluminescence) also suggest that these structures hold potential usefulness for insulated gate GaAs circuitry. Author (GRA)

N77-27008# Illinois Univ., Urbana-Champaign. Dept. of Physics.
THE ELECTRONIC STRUCTURE OF CRYSTALLINE SOLIDS: THEIR SURFACES AND INTERFACES Final Report, 1 Jan. 1972 - 31 Mar. 1976
A. Barry Kunz Wright-Patterson AFB, Ohio AFAL Feb. 1977 163 p refs
(Contract F33615-72-C-1506; AF Proj. 7885)
(AD-A037797; AFAL-TR-76-140) Avail: NTIS HC A08/MF A01 CSCL 20/11

This project was designed to study accurate, non-empirical theoretical techniques which permit one to have a predictive theoretical capability for systems of interest in electronic devices of a solid state nature. Thus, the classes of materials of interest include insulator (principally oxides), semiconductors, and some metals. Properties of bulk crystalline solids are needed as are properties of surfaces and interfaces. It is desired to develop a unified technique for all classes of systems. The most general available technique is the Hartree-Fock Self-Consistent Field Method. In this case for most, if not all solids, this is best implemented by means of a local-orbital transformation. Since the Hartree-Fock method is a mean-field theory, inclusion of correlation corrections is important for studies of ground state properties (charge densities, Compton profiles, equilibrium lattice spacings). The best method overall, in terms of economy and accuracy, is the electronic-polaron model in its improved form. Similar techniques are viable for surface state and interface state studies. GRA

N77-27009# RCA Labs., Princeton, N. J.
PLANAR CMOS/SOS ARRAY DEVELOPMENT Final Report, 1 Apr. 1975 - 31 Aug. 1976
Charles E. Weitzel Dec. 1976 84 p refs
(Contract F33615-72-C-1291)
(AD-A037752; PRRL-76-CR-4; AFAL-TR-76-246) Avail: NTIS HC A05/MF A01 CSCL 20/12

Three techniques for planarizing silicon-on-sapphire epitaxial islands are investigated. These three approaches are thermal oxidation isolation, ion-implantation isolation, and SIS (silicon-in-sapphire). N-channel MOS transistors fabricated using thermal oxidation isolation exhibit large edge leakage currents and are bias-temperature unstable. Stable p-channel MOS transistors can be fabricated if the field oxide is grown below 950 C in HCl steam. Test transistors fabricated using ion-implantation isolation show very large edge leakage current. GRA

N77-27010# Systems Research Labs., Inc., Dayton, Ohio.
ION IMPLANTATION IN COMPOUND SEMICONDUCTORS Final Report, Jan. 1972 - Mar. 1976
Elward T. Bodine, Ronald R. Berliner, and Bok Kyoon Shin Jan. 1977 159 p refs
(Contract F33615-72-C-1099; AF Proj. 7885)
(AD-A037958; SRL-6739; AFAL-TR-76-218) Avail: NTIS HC A08/MF A01 CSCL 20/12

Ion implantation has been investigated as a method of controlled doping of compound semiconductors. Ion implantation into III-V and II-VI compounds has been performed. Analysis of the as grown, implanted, and annealed specimens has been performed with a variety of characterization techniques. The development of some new experimental capabilities is discussed. Author (GRA)

N77-27011# Rockwell International Corp., Anaheim, Calif. Electronics Research Div.
INVESTIGATION OF DEFECTS AND IMPURITIES IN SILICON-ON-SAPPHIRE Final Report, 15 Jan. 1975 - 30 Jun. 1976
Ross A. Williams, Jan E. A. Maurits, J. L. Peel, and Frieda F. Mittelbach Hanscom AFB, Mass. RADC Nov. 1976 109 p
(Contract F19628-75-C-0108)
(AD-A037753; C75-370/501; RADC-TR-76-356) Avail: NTIS HC A06/MF A01 CSCL 09/5

With the use of silicon-on-sapphire (SOS) in the manufacture of MOS/LSI circuitry rapidly approaching reality for military applications, the problem of nonuniform and inconsistent quality from lot-to-lot and wafer-to-wafer in commercially available SOS material must be dealt with. The first phase of this program examines the relationship between defects and impurities in the sapphire starting material and the quality of devices fabricated in silicon films grown on the sapphire. The quality of the sapphire was examined using selective etching, X-ray topography, ion-microprobe-mass-analyzer (IMMA), and scanning electron microscope. Device quality was determined on the basis of yield, electrical parameters, and radiation hardness of CMOS inverters. Sapphire growth, sapphire polishing, and Si film growth were done by several manufacturers in different combinations, and the results of the different combinations of manufacturers compared. The second phase of the program investigated the relationship between different pre-epitaxial treatments of the sapphire and CMOS device quality. GRA

N77-27012# Office of Naval Research, London (England).
SYMPOSIUM ON THE STRUCTURE OF NON-CRYSTALLINE MATERIALS
P. Craig Taylor 15 Feb. 1977 10 p
(AD-A037948; ONRL-C-1-77) Avail: NTIS HC A02/MF A01 CSCL 11/2

In this symposium, which attracted contributions from both the amorphous semiconductors and the glass sciences communities, recent results were presented concerning the structure of non-crystalline solids as deduced from several different experimental techniques. These techniques include X-ray diffraction, extended X-ray absorption fine structure (EXAFS), infra-red and Raman spectroscopy, low temperature specific heat, and electron spin resonance (ESR). The symposium featured discussions of recent EXAFS measurements and methods of data reduction, of defects in semiconducting and oxide glasses, and of structural modelling techniques including continuous random network models. Author (GRA)

N77-27013# Pennsylvania State Univ., University Park. Materials Research Lab.
TEMPERATURE COMPENSATED PIEZOELECTRIC MATERIALS Semiannual Technical Report, 1 Jan. - 31 Jun. 1976
G. R. Barsch and K. E. Spear Oct. 1976 26 p refs
(Contract F19628-75-C-0085; ARPA Order 2826; AF Proj. 2826)
(AD-A037796; RADC-TR-76-323; SATR-3) Avail: NTIS HC A03/MF A01 CSCL 20/2

In order to search for new temperature compensated materials for surface acoustic wave (SAW) devices with low ultrasonic attenuation and high electro-mechanical coupling, the following experimental and theoretical investigation were carried out. Extensive crystal growth investigations were carried out for $Pb_2KNb_5O_{15}$, Li_2SiO_3, $Ba_2Si_2TiO_8$, $Ba_2Ge_2TiO_8$, and Bi_2MoO_5, using Czochralski or flux-pulling methods. Progress in reducing the cracking problem was made by improved temperature control during growth and subsequent cooling, and by reducing variations in the diameter of the boule during growth. Except for $LiSiO_3$, millimeter size or larger specimen of fair to good quality have been obtained. The ferroelectric transition temperature and the lattice parameters have been stuided for the system $xK_2O + yPbO + zNb_2O_5$ in the vicinity of the stoichiometric composition corresponding to $Pb_2KNb_5O_{15}$, and the possible implications for the composition dependence of the elastic, thermoelastic and piezoelectric constants and for attaining large electromechnical coupling factor with temperature compensated cuts are discussed. The two piezoelectric constants of $AlPO_4$ are presently being measured by the X-ray method. GRA

N77-27014# Oregon State Univ., Corvallis. Dept. of Chemistry.
GROWTH OF PURE SINGLE CRYSTALS OF ALKALI HALIDES AND ALKALINE EARTH FLUORIDE Semiannual Report, 1 Mar. - 31 Aug. 1976
W. J. Fredericks 1 Sep. 1976 27 p refs
(Contract F19628-76-C-0156; ARPA Order 3096)
(AD-A037795; RADC-TR-77-27; SR-1) Avail: NTIS HC A03/MF A01 CSCL 20/2

This first semiannual technical report describes our progress on developing an ion exchange - reactive gas purification scheme for potassium bromide, strontium fluoride and barium fluoride. Measurements of the removal fraction of alkali ion impurity as a function of number of resin bed volumes and KBr concentration are given for the ion exchange resin Chelex 100. The design of

a contamination-free reactive gas seal and the reactive gas manifold are discussed. Author (GRA)

N77-27015# Westinghouse Research Labs., Pittsburgh, Pa.
EVALUATION OF SULFOSALTS Semiannual Report
Thelma J. Isaacs, R. W. Weinert, and J. P. McHugh Dec. 1976 44 p refs
(Contract F19628-76-C-0158; ARPA Order 3151)
(AD-A037946; Rept-76-9C4-SASSI-R1; RADC-TR-76-403)
Avail: NTIS HC A03/MF A01 CSCL 20/2

Investigations into phase equilibria relations in the system Tl-V-S show it to be complex, with multiple arrests and supercooling presenting problems in determining composition and melting relationships. The maximum melting composition has not as yet been determined, but it probably does not lie on any 'pseudobinary' join. The best crystals which we have grown have been of nonstoichiometric composition, fractionally richer in Tl and S2. Studies on parameters of crystal growth are proceeding, with work now being performed varying the rate of growth while keeping the composition constant. The material constants and their temperature coefficients have been measured and, with the exception of the piezoelectric constant temperature coefficient, little change is expected in these constants as crystal quality improves. The computer program used to calculate surface wave properties is being re-worked and should be available for use shortly. A SAW filter has been demonstrated on the (001) plane of Tl3VS4. Author (GRA)

N77-27016# Office of Naval Research, London (England).
LATTICE DEFECTS IN IONIC CRYSTALS: REPORT ON THE BERLIN CONFERENCE (1976)
L. M. Slifkin (North Carolina Univ., Chapel Hill) and J. H. Schulman 22 Feb. 1977 26 p
(AD-A037950; ONRL-C-37-76) Avail: NTIS HC A03/MF A01 CSCL 20/2

Salient problems and recent progress in the study of lattice defects in ionic solids were covered by excellent tutorial reviews and numerous contributed papers. This Report gives a general overview of the meeting and briefly summarizes a large fraction of the papers. Author (GRA)

N77-27017# Yeshiva Univ., New York.
ELECTRONIC ENERGY LEVELS IN IMPERFECT SOLIDS Interim Technical Report
Daniel C. Mattis Jan. 1977 89 p refs
(Contract N00014-76-C-0690; NR Proj. 392-015)
(AD-A035723; TR-1) Avail: NTIS HC A05/MF A01 CSCL 20/12

Several scattering-theoretic formulations of the theory of solids are used to discuss the energy levels associated with imperfections, surface states, and electron energy levels in highly disordered substances. The theoretical bases are thoroughly developed and illustrated. Author (GRA)

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N77-27018# California Univ., Livermore. Lawrence Livermore Lab.
KOVEC USER'S MANUAL
J. P. Woodruff Nov. 1976 89 p refs
(Contract W-7405-eng-48)
(UCID-17306) Avail: NTIS HC A05/MF A01

KOVEC is a one-dimensional, Lagrangian, elastic-plastic material motion code that is available for both 7600 and STAR computers. The elastic-plastic formulation is in the principal stress coordinate system; the Von Mises yield condition is used. Models for work hardening and temperature- and pressure-dependent yield strength and shear modulus are available. The hydrodynamic equations of state are analytic functions of relative volume and total internal energy. The coding allows an unlimited number of voids to open and close. The present document describes both the physics models and the user features of the KOVEC code. ERA

N77-27019# National Bureau of Standards, Washington, D. C. Physical Chemistry Div.
COMPUTER PROGRAMS FOR THE EVALUATION OF ACTIVITY AND OSMOTIC COEFFICIENTS Final Report
Bert R. Staples and Ralph L. Nuttall Dec. 1976 59 p refs
(PB-262600/0; NBS-TN-928) Avail: NTIS HC A04/MF A01 CSCL 07D

A number of specialized computer programs were developed for calculating thermodynamic properties directly from experimental data. They can also be used for subsequent data manipulation, including nonlinear least squares fitting of the data to empirical or semiempirical equations that describe the function over a range of compositions, temperatures or other parameters. The details of the programs used in the critical evaluation of mean activity and osmotic coefficients and sample runs for each program are discussed. Osmotic coefficients can be calculated from direct vapor pressure measurements or from isopiestic molalities. Activity coefficients can be calculated from electromotive force measurements of galvanic cells, both without liquid junction and with transference. A nonlinear least squares program fits data from all sources as a function of phi and ln gamma. Once the parameters of the fitting equation have been obtained, another program can be used to calculate a table of m, gamma, phi, a(w), and delta G(ex) at rounded molalities. GRA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N77-27020*# Battelle Columbus Labs., Ohio.
FACTORS AFFECTING THE CORPORATE DECISIONMAKING PROCESS OF AIR TRANSPORT MANUFACTURERS Final Report
R. G. Ollila, J. D. Hill, B. R. Noton, M. A. Duffy, and M. M. Epstein 15 Dec. 1976 118 p refs
(Contract NASw-2970)
(NASA-CR-154618) Avail: NTIS HC A06/MF A01 CSCL 05A

Fuel economy is a pivotal question influencing the future sale and utilization of commercial aircraft. The NASA Aircraft Energy Efficiency (ACEE) Program Office has a program intended to accelerate the readiness of advanced technologies for energy efficient aircraft. Because the decision to develop a new airframe or engine is a major financial hazard for manufacturers, it is important to know what factors influence the decision making process. A method is described for identifying and ranking individuals and organizations involved at each stage of commercial air transport development, and the barriers that must be overcome in adopting new technologies. A.R.H.

N77-27021*# Gellman Research Associates, Inc., Jenkintown, Pa.
ANALYSIS OF FLIGHT EQUIPMENT PURCHASING PRACTICES OF REPRESENTATIVE AIR CARRIERS Final Report
Jan. 1977 81 p ref
(Contract NASw-2969)
(NASA-CR-154619) Avail: NTIS HC A05/MF A01 CSCL 05A

The process through which representative air carriers decide whether or not to purchase flight equipment was investigated as well as their practices and policies in retiring surplus aircraft. An analysis of the flight equipment investment decision process in ten airlines shows that for the airline industry as a whole, the flight equipment investment decision is in a state of transition from a wholly informal process in earliest years to a much more organized and structured process in the future. Individual air carriers are in different stages with respect to the formality and sophistication associated with the flight equipment investment decision. Author

N77-27022# California Univ., Berkeley. Lawrence Berkeley Lab.

LABORATORY EQUIPMENT PROCUREMENT

Dick A. Mack Aug. 1976 23 p refs Presented at the Conf. on Management of Lab. Instr., Cairo, 5-14 Nov 1976

(Contract W-7405-eng-48)

(LBL-5504; Conf-761105-3) Avail: NTIS He A02/MF A01

As the emphasis of a research organization changes or its facilities are modernized it is important that the instrumentation supporting such research keep abreast of the current needs of the institution. Before acquiring new equipment one must consider the tradeoff between modifying old units and acquiring new, the obsolescence of old technologies in the light of new techniques, and the maintenance costs of older units contrasted with the cost of acquisition of new models. If a decision has been reached that new equipment is required, many factors must be considered before the actual purchase is undertaken. Considerations in translating an experimental need into the completed delivery of an instrument are discussed. ERA

N77-27023# Stanford Research Inst., Menlo Park, Calif.

ACS. 1: AN EXPERIMENTAL MANAGEMENT TOOL

Marshall C. Pease, III 1976 35 p refs

(Contract N00014-71-C-0210)

(AD-A037311; SRI-TR-13) Avail: NTIS HC A03/MF A01 CSCL 05/1

This paper describes the current state of a program of research on systems providing automated support for high level managers. The program seeks to apply some of the techniques of knowledge-based inference that have been developed by the artificial intelligence community, and to develop means for their application is decision-making environments. GRA

N77-27024# Stanford Research Inst., Menlo Park, Calif.

RESEARCH ON LARGE FILE MANAGEMENT INFORMATION SYSTEMS Annual Report

Marshall C. Pease, III, Jack Goldberg, and Daniels Sagalowicz Jan. 1977 20 p refs

(Contract N00014-71-C-0210)

(AD-A037161) Avail: NTIS HC A02/MF A01 CSCL 05/2

This is an annual summary of SRI's program of research on Large File Management Information Systems. In this report will be described the present status of the research and our plans for the immediate future, our past accomplishments, and give a general description of ACS. 1, an operationa, experimental system currently being developed. GRA

N77-27025# Defense Systems Management School, Fort Belvoir, Va.

ASSESSMENT OF THE UTILITY/UTILIZATION OF THE AIR FORCE LABORATORIES BY THE SYSTEM PROGRAM ORGANIZATIONS

Charles E. Payne 10 Nov. 1976 39 p refs

(AD-A037758) Avail: NTIS HC A03/MF A01 CSCL 15/5

The purpose of this report is to provide a summary tool for both the laboratory and the System Program Organization (SPO) to assess the current status of the interactive processes between those organizations. The report was developed through reference to several prior studies related generally to the same topic area including several interviews with laboratory and SPO personnel. A considerable number of suppositions are subsequently made regarding the likely affects of several current and planned changes in the laboratory mission and organizational structure. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N77-27026# California Univ., Livermore. Lawrence Livermore Lab.

EXPERIMENT IN INFORMATION SHARING: THE LLL-ATLANTA UNIVERSITY WORKSHOPS

Lorene B. Brown (Atlanta Univ.), H. L. Fisher, and I. Harrison, Jr. 6 Dec. 1976 15 p Workshops held at Atlanta, 1976

(Contract W-7405-eng-48)

(UCID-17340) Avail: NTIS HC A02/MF A01

A series of information retrieval workshops was held at Atlanta University during 1976 to acquaint library personnel from low budget and/or minority colleges and universities with modern on-line information retrieval technology and give them hands-on experience with some of the equipment involved. Information retrieval specialists from Lawrence Livermore Laboratory conducted the workshops, with the assistance of the School of Library Service at Atlanta University. Enthusiastic response from the participants indicates that these workshops were highly successful in accomplishing their objectives. The workshops were highly successful in accomplishing their objectives. The workshops are briefly described, and the responses of the participants to evaluative questionnaires are reported.ERA

N77-27027# National Federation of Abstracting and Indexing Services, Philadelphia, Pa.

A STUDY OF COVERAGE OVERLAP AMONG FOURTEEN MAJOR SCIENCE AND TECHNOLOGY ABSTRACTING AND INDEXING SERVICES Summary Report

Toni Carbo Bearman and William A. Kunberger 30 Nov. 1976 94 p refs

(Contract NSF C-875)

(PB-264559/6; NFAIS-76-1) Avail: NTIS HC A05/MF A01 CSCL 05B

Five thousand four hundred sixty-six of the 26,000 journals scanned by 14 major scientific and technical abstracting and indexing services were analyzed to determine duplication of coverage. Calculations show that 23.4% of those articles abstracted and/or indexed by any of the services from the 5,466 journals were indexed by at least 2 services. Percentages for the 14 individual services reflecting the fraction of all 1973 articles indexed by each service which were indexed by at least one other service were also computed. Upper bounds were determined for the amount of overlap possible for each pair of services. All 7-way and greater overlap was determined. Altogether 9 articles were found to be asstracted and/or indexed by 7 services. No articles were indexed by more than 7 services.GRA

N77-27028# Adjutant Generals Office (Army), Washington, D. C.

STUDY OF US ARMY LIBRARIES. VOLUME 2: DIRECTORY Final Report, Sep. 1975 - Jul. 1976

Vernon E. Palmour, Marcia C. Bellassai, and Louise Nyce Jul. 1976 139 p

(AD-A036002; LS76-1-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 05/2

This directory is composed of the address list compiled for the Army Library Study, September 1975 - July 1976. The address list was assembled from lists provided by the staff librarians of the various major commands, and by the chief librarians for headquarters agencies. It was then checked against the listing for the Federal Library Survey, 1972, and against Army accountability listings. Several addresses were listed later from information uncovered during the study. Service outlets indicated refer to the total number of libraries within the system, and include the main libray. The names of library director/operating official who responded to the questionnaire, which was part of the Army Library Study, are listed, and current insofar as possible. Further listing of all GS-1410 series librarians is presented as of July 1976. Operating director of librarians who are in other than the GS-1410 series are noted and identified with an

asterisk (*). Their series or classification is listed where known. Arrangement of this directory is by type of library, then by Command/Agency. Telephone numbers are AUTOVON unless otherwise indicated. Numbers shown in the left column are the Army Library Study's identifying number. GRA

N77-27029# Adjutant Generals Office (Army), Washington, D. C.
COMPUTER OUTPUT MICROFORMS PROGRAM AND CONCEPT STUDY (COMPACS) REPORT Final Report, Dec. 1974 - Sep. 1976
Charles T. Search and Carl Bielenberg 1 Sep. 1976 360 p refs
(AD-A035992; DAAG-AMZ-1) Avail: NTIS HC A16/MF A01 CSCL 14/5

The purpose of COMPACS' was to conduct a program and systems development study for converting the Army's Base Operating Information System (BASOPS) to Computer Output Microfiche (COM). Through appropriate testing at four of th Army's 42 BASOPS installations and analysis of data collected at all other BASOPS installations, the Study Group validated those outputs capable of being converted to microfiche. The Group also determined the equipment required to satisfy user requirements determined that the BASOPS - COM Microform Document Information System MICRODIS is cost effective and developed a plan for implementing a standard BASOPS - COM MICRODIS at all BASOPS installations. The study found that COM was a desirable, feasible, and economical means of producing at least 80% of the BASOPS output. The Group also developed appropriate standards, implementation plans, and extension schedules for converting all BASOPS installations to COM. GRA

N77-27030# RAND Corp., Santa Monica, Calif.
RAND LIBRARY EVALUATION SURVEY
Cecily J. Surace, Marilyn Schoen, and Donald P. Trees Jun. 1976 63 p
(AD-A037917; P-5667) Avail: NTIS HC A04/MF A01 CSCL 05/2

A Rand Library user survey was conducted in February 1975. The basic objective involved the collection of sufficient baseline data describing user characteristics, usage, and satisfaction parameters to enable specific library policy alternatives to be evaluated. The codebook gives a brief overview of the survey instrument design, the data collection methodology, the data reduction process and the structure and distribution of the data, including actual response frequencies. The preliminary analysis is included to provide the policy context for the survey and some additional interpretive information. Author (GRA)

N77-27031# Parke Mathematical Labs., Inc., Carlisle, Mass.
A COMPUTER STORAGE AND RETRIEVAL SYSTEM FOR SCIENTIFIC DATA Final Report, Sep. 1973 - Jul. 1976
Theodore B. Barrett and Ingrid B. Jarvis Sep. 1976 173 p refs
(Contract F19628-74-C-0031)
(AD-A037738; RADC-TR-76-344) Avail: NTIS HC A08/MF A01 CSCL 05/2

A computer storage and retrieval system for use with a CDC 6600 computer as it is configured at AFGL, Hanscom AFB, was developed. The information stored and retrieved falls into three categories: source citation (bibliographic), data category (keyword) and scientific data (usually quantitative measurements on various properties of a selected class of materials). This report gives a general and specific description of this system which consists of computer subroutines, files and operational procedures. In addition it provides a detailed user's guide for operating the system. Author (GRA)

N77-27032# RAND Corp., Santa Monica, Calif.
PRIVACY AND SECURITY ISSUES IN INFORMATION SYSTEMS
Rein Turn and Willis H. Ware Jul. 1976 36 p refs
(AD-A037896; P-5684) Avail: NTIS HC A03/MF A01 CSCL 05/2

Central in privacy protection are the rights of an individual to know what data are maintained on him, challenge their veracity and relevance, limit their nonroutine use or dissemination, and be assured that their quality, integrity, and confidentiality are maintained. In all computer systems that maintain and process valuable information, or provide services to multiple users concurrently, it is necessary to provide security safeguards against unauthorized access, use, or modifications of any data file. Computer systems must also be protected against unauthorized use, disruption of operations, and physical damage. GRA

N77-27033# Adjutant Generals Office (Army), Washington, D. C.
STUDY OF US ARMY LIBRARIES, VOLUME 1 Final Report, Sep. 1975 - Jul. 1976
Vernon E. Palmour, Marcia C. Bellassai, and Louise Nyce Jul. 1976 240 p refs
(AD-A036004; LS76-1-Vol-1) Avail: NTIS HC A11/MF A01 CSCL 05/2

This report addresses the development of programs for increasing efficiency in operation of Army libraries to meet expanding demands for services with static budgets. Army libraries are descibed in terms of type, resources and expenditures. Problems of current operational patterns are identified. The report recommends establisment of an Army Libraries Management Office (ALMO) which would determine goals, objectives, and priorities for Army libraries, develop uniform standards for operation and support, and develop and coordinate cooperative programs in sharing resources, shared cataloging, and centralized procurement of materials. An Army Libraries Advisory Council (ALAC) is also recommended to maintain continuous two-way communications between the ALMO and operational libraries. Author (GRA)

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N77-27034*# Stanford Research Inst., Menlo Park, Calif.
TECHNOLOGY TRANSFER: TRANSPORTATION Biannual Report, 15 Aug. 1974 - 31 Dec. 1976
Tom Anyos, Ian Brown, Ruth Lizak, Andrew Loomis, and James Wilhelm Apr. 1977 192 p refs
(Contract NAS2-9318; SRI Proj. 3670)
(NASA-CR-153272) Avail: NTIS HC A09/MF A01 CSCL 05B

The application of NASA derived technology in solving problems related to highways, railroads, and other rapid systems is described. Additional areas/are identified where space technology may be utilized to meet requirements related to

waterways, law enforcement agencies, and the trucking and recreational vehicle industries. Author

N77-27035*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A COMPUTERIZED TRAFFIC CONTROL ALGORITHM TO DETERMINE OPTIMAL TRAFFIC SIGNAL SETTINGS Ph.D. Thesis - Toledo Univ.
Kurt Seldner Mar. 1977 255 p refs
(NASA-TM-X-73607; E-9084) Avail: NTIS HC A12/MF A01 CSCL 13F

An algorithm was developed to optimally control the traffic signals at each intersection using a discrete time traffic model applicable to heavy or peak traffic. Off line optimization procedures were applied to compute the cycle splits required to minimize the lengths of the vehicle queues and delay at each intersection. The method was applied to an extensive traffic network in Toledo, Ohio. Results obtained with the derived optimal settings are compared with the control settings presently in use. Author

N77-27036# California Univ., Livermore. Lawrence Livermore Lab.
TRANSPORTATION-RELATED DATA BASES EXTRACTED FROM THE NATIONAL INDEX OF ENERGY AND ENVIRONMENTAL DATA BASES. PART 1: DIGEST OF DETAILED DATA BASE DESCRIPTIONS
E. W. Birss and J. W. Yeh 15 Nov. 1976 133 p
(Contract W-7405-eng-48)
(UCID-17316-Pt-1) Avail: NTIS HC A07/MF A01

Lawrence Livermore Laboratory (LLL) extracted a set of 135 transportation-related data bases from a computerized national index of energy and environmental data bases which LLL had produced for the Division of Biomedical and Environmental Research of the Energy Research and Development Administration. These 135 data bases, which relate to the intersection of the energy and transportation fields, initially served as a model for designing a questionnaire for transportation-related data bases and were subsequently converted into a DOT survey data base format. A digest and detailed description of each data base is presented. The format includes: data base name, administrative control and technical content personnel, data base category, coverage and availability, hardware/software environment, documentation and application, and abstract and objectives. ERA

N77-27037# California Univ., Livermore. Lawrence Livermore Lab.
TRANSPORTATION-RELATED DATA BASES EXTRACTED FROM THE NATIONAL INDEX OF ENERGY AND ENVIRONMENTAL DATA BASES. PART 2: DETAILED DATA BASE DESCRIPTIONS
E. W. Birss and J. W. Yeh 15 Nov. 1976 277 p
(Contract W-7405-eng-48)
(UCID-17316-Pt-2) Avail: NTIS HC A13/MF A01
For abstract, see N77-27036.

N77-27038# World Meteorological Organization, Geneva (Switzerland).
WEATHER, CLIMATE AND HUMAN SETTLEMENTS
H. E. Landsberg 1976 55 p
(WMO-448; SER-7; ISBN-92-63-10448-4) Avail: NTIS HC A04/MF A01

The role weather and climate play in urban planning and in the development of new settlements is described. In particular the following aspects are considered: weather disasters such as storms and floods; climate and energy use; climate and building construction; air pollution; climate and land use; climate and recreation; and the effects of urbanization on climate. ESA

N77-27039# Louisiana State Univ., Baton Rouge.
ENZYME PROCESS DESIGN FOR WATER TREATMENT M.S. Thesis
Steven Wayne Johnston Dec. 1976 108 p refs
(Contract DI-14-34-0001-6019)
(PB-264504/2; W77-05336; OWRT-A-036-LA(2)) Avail: NTIS HC A06/MF A01 CSCL 13B

A proposed process to remove sucrose from waste water is examined. Boric acid is known to form acidic complexes with certain compounds containing adjacent hydroxyl groups. If boric acid would react with sucrose a complex would form that could be removed by ion exchange. For the process to work, sucrose must be converted to glucose and fructose by enzymatic hydrolysis with invertase. The free enzymatic hydrolysis were examined, and adsorption tests were run. GRA

N77-27040# DeLeuw, Cather and Co., Houston, Tex.
URBAN TRAFFIC CONTROL SYSTEM TRAFFIC ADAPTIVE NETWORK SIGNAL TIMING PROGRAM. VOLUME 1: OVERVIEW DESCRIPTION; NARRATIVE DESCRIPTION AND FLOW CHARTS OF TANSTP ROUTINES Final Report
R. W. Kessmann Aug. 1976 291 p 3 Vol.
(Contract DOT-FH-11-7594)
(PB-264054/8; FHWA-RD-76-125-Vol-1) Avail: NTIS HC A13/MF A01 CSCL 13B

The Traffic Adaptive Newtwork Signal Timing Program (TANSTP) is a second generation traffic control package wherein optimal traffic signal timing patterns are generated on-line as a function of current and predicted traffic flow conditions to minimize average network vehicle delay. In addition to the network optimization routine, the package includes a traffic flow predictor, realtime subnetwork determination routine, a subnetwork interfacing routine, a transition optimization routine, and a local insersection optimization routine which adjusts splits and offsets to minimze delay on a cycle by cycle basis. The TANSTP package uses the executive structure, the detector processing, and the controller command software of the first generation, UTCS software. GRA

N77-27041# DeLeuw, Cather and Co., Houston, Tex.
URBAN TRAFFIC CONTROL SYSTEM TRAFFIC ADAPTIVE NETWORK SIGNAL TIMING PROGRAM. VOLUME 2: DATA BASE INTERFACE AND SUPPORT SUBROUTINES: MODIFIED FIRST GENERATION ROUTINES Final Report
R. W. Kessmann Aug. 1976 295 p 3 Vol.
(Contract DOT-FH-11-7594)
(PB-264055/5; FHWA-RD-76-126-Vol-2) Avail: NTIS HC A13/MF A01 CSCL 13B
For abstract, see N77-27040.

N77-27042# DeLeuw, Cather and Co., Houston, Tex.
URBAN TRAFFIC CONTROL SYSTEM TRAFFIC ADAPTIVE NETWORK SIGNAL TIMING PROGRAM. VOLUME 3: UTCS/TANSTP DATA BASE AND DATA BASE UPDATE PROCEDURES; OFFLINE SUPPORT PROGRAMS; OPERATING PROCEDURES Final Report
R. W. Kessmann Aug. 1976 205 p refs 3 Vol.
(Contract DOT-FH-11-7594)
(PB-264056/3; FHWA-RD-76-127-Vol-3) Avail: NTIS HC A10/MF A01 CSCL 13B
For abstract, see N77-27040.

N77-27043# Environmental Protection Agency, New York. Data Systems Branch.
THE COMPUTATION AND GRAPHICAL DISPLAY OF THE NSF WATER QUALITY INDEX FROM THE STORET DATA BASE USING THE INTEGRATED PLOTTING PACKAGE. PROGRAM DOCUMENTATION AND USERS GUIDE Final Report
George A. Nossa Oct. 1976 98 p refs
(PB-264670/1; WQI-001) Avail: NTIS MF A01 CSCL 13B

The NSF-Water Quality index is a numerical expression which reflects the composite influence of nine physical, chemical and bacteriological parameters to water quality. It was developed and has been widely field tested by the National Sanitation Foundation as a means for reporting the current status and trends of water quality. Documentation includes the logic and operation of three computer programs developed to present this index in report and/or graphical form using the Storet Database as input and the graphics capability of the Integrated Plotting Package. Data from the Raritan Basin is presented as a test application. GRA

N77-27044# Minnesota Univ., Minneapolis. Dept. of Aerospace Engineering and Mechanics.
VEHICLE FOLLOWER LONGITUDINAL CONTROL FOR AUTOMATED GUIDEWAY TRANSIT VEHICLES

R. J. Caudill and W. L. Garrard Feb. 1977 282 p refs Sponsored by UMTA
(PB-264554/7; UMTA-MN-11-0002-77-1) Avail: NTIS HC A13/MF A01 CSCL 13P

Relatively small automated transit vehicles are proposed as a method for providing expanded transit service without the labor costs and reliability problems associated with the bus and without the high capital costs associated with rapid rail systems. Basic considerations in vehicle-follower longitudinal control for small, automated transit vehicles operating at moderate speeds and short headways are discussed. The relationship between spacing policy, system nonlinearities, and dynamic response of strings of vehicles is examined. GRA

N77-27045# Texas Municipal League, Austin.
MANAGEMENT ASSISTANCE FOR TEXAS CITY GOVERNMENTS. VOLUME 1: APPENDICES A-C Final Report, 1974 - 1976
May 1976 136 p Prepared in cooperation with Texas A and M Univ., College Station
(Contract HUD-H-2182)
(PB-264866/5) Avail: NTIS HC A07/MF A01 CSCL 13B

During an 18-month period beginning in 1974, eight projects tested approaches to improving the overall policy development and management capacity of local elected and appointed officials. The demonstration had a dual thrust--making changes at the local level and organizing resources for assistance. The conceptualization, organization, and implementation of the Texas Management Assistance Project are discussed. Technical aspects of assistance to 13 cities in management development and reporting, citizen communications, personnel system design, budgeting performance, and productivity measurement are described. Of particular interest are the development methods for transfer of assistance to twelve additional cities. Diagnostic tools and work planning techniques are detailed. GRA

88 SPACE SCIENCES (GENERAL)

N77-27046*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN INTEGRATED CIRCUIT FLOATING POINT ACCUMULATOR
Theodore C. Goldsmith Washington Jun. 1977 25 p refs
(NASA-TN-D-8509; G-7702-F12) Avail: NTIS HC A02/MF A01 CSCL 14B

Goddard Space Flight Center has developed a large scale integrated circuit (type 623) which can perform pulse counting, storage, floating point compression, and serial transmission, using a single monolithic device. Counts of 27 or 19 bits can be converted to transmitted values of 12 or 8 bits respectively. Use of the 623 has resulted in substantial savaings in weight, volume, and dollar resources on at least 11 scientific instruments to be flown on 4 NASA spacecraft. The design, construction, and application of the 623 are described. Author

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N77-27047*# California Univ., Berkeley. Dept. of Physics.
INFRARED UPCONVERSION FOR ASTRONOMY
Robert W. Boyd [1977] 33 p refs
(Grants NGL-05-003-272; NGR-05-003-452)
(NASA-CR-153393) Avail: NTIS HC A03/MF A01 CSCL 03A

The basic theory of upconversion is presented, along with a brief historical summary of upconversion techniques. Upconverters were used in astronomical studies, but have met with only modest success. Upconversion will become a useful detection method for astronomy only if substantial but perhaps forseeable, improvements can be realized. Author

N77-27048*# California Univ., Berkeley.
A SENSITIVE INFRARED IMAGING UP CONVERTER AND SPATIAL COHERENCE OF ATMOSPHERIC PROPAGATION
R. W. Boyd and C. H. Townes [1977] 14 p refs
(Grant NGL-05-003-272; NGR-05-003-452)
(NASA-CR-149891) Avail: NTIS HC A02/MF A01 CSCL 03A

An infrared imaging technique based on the nonlinear interaction known as upconversion was used to obtain images of several astronomical objects in the 10 micrometer spectral region, and to demonstrate quantitatively the sharper images allowed for wavelengths beyond the visible region. The deleterious effects of atmospheric inhomogeneities on telescope resolution were studied in the infrared region using the technique developed. The low quantum efficiency of the device employed severely limited its usefulness as an astronomical detector. Author

N77-27049*# California Univ., Berkeley. Dept. of Physics.
SPATIAL HETERODYNE INTERFEROMETRY OF VY CANIS MAJOR'S, ALPHA ORIONIS, ALPHA SCORPII, AND R LEONIS AT 11 MICRONS
E. C. Sutton, J. W. V. Storey, A. L. Betz, C. H. Townes, and D. L. Spears [1977] 18 p refs
(Grants NGL-05-003-272; NGR-05-003-452; MSF AST-75-20353)
Avail: NTIS HC A02/MF A01 CSCL 03A

Using the technique of heterodyne interferometry, measurements were made of the spatial distribution of 11 micron radiation from four late type stars. The circumstellar shells surrounding VY Canis Majoris, alpha Orionis, and alpha Scorpii were resolved, whereas that of R Leonis was only partially resolved at a fringe spacing of 0.4 sec. Author

N77-27050*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OSO-8 X-RAY OBSERVATIONS OF AM HERCULIS
J. Swank, M. Lampton (Maryland Univ.), E. Boldt, S. Holt, and P. Serlemitsos May 1977 16 p refs Submitted for publication
(NASA-TM-X-71313; X-661-77-104) Avail: NTIS HC A02/MF A01 CSCL 03A

Hard X-ray observations of the binary system AM Her were coincident with soft X-ray and ground-based optical measurements. In the 2-60 KeV band, variability was detected with an eclipse during phases 0.5 to 0.7 with respect to the 0. d 12892 period optical minima, synchronous with the known soft X-ray eclipse. The 2-60 KeV uneclipsed flux was 9.5 x 10 to the minus 10th power erg sq cm/sec, of which 86% lies above 10 keV. Thus AM Her contains a hard source located near the similarly eclipsed soft X-ray source. The X-ray data are interpreted in terms of thermal bremsstrahlung from accretion onto a white dwarf. Author

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

No abstracts in this category.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N77-27051*# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
CHARACTERIZATION AND DISTRIBUTION OF LUNAR MARE BASALT TYPES USING REMOTE SENSING TECHNIQUES Ph.D. Thesis
Carle Pieters May 1977 350 p refs
(Grants NsG-7048)
(NASA-CR-153267) Avail: NTIS HC A15/MF A01 CSCL 03B

The types of basal to be found on the moon were identified using reflectance spectra from a variety of lunar mare surfaces and craters as well as geochemical interpretations of laboratory measurements of reflectance from lunar, terrestrial, and meteoritic samples. Findings indicate that major basaltic units are not represented in lunar sample collections. The existence of late stage high titanium basalts is confirmed. All maria contain lateral variations of compositionally heterogenous basalts; some are vertically inhomogenous with distinctly different subsurface composition. Some basalt types are spectrally gradational, suggesting minor variations in composition. Mineral components of unsampled units can be defined if spectra are obtained with sufficient spectral coverage (.3 to 2.5 micron m) and spatial resolution (approximating .5 km). Author

N77-27052*# Queens Coll., Flushing, N. Y. Dept. of Earth and Environmental Sciences.
RADIOGRAPHIC ANALYSIS OF SEDIMENTARY STRUCTURES AND DEPOSITIONAL HISTORIES IN APOLLO 15 CORES Final Report
Nicholas K. Coch [1977] 31 p refs Original contains color illustrations
(Grant NsG-9022)
(NASA-CR-153265) Avail: NTIS HC A03/MF A01 CSCL 03B

Radiographs of the Apollo 15 deepdrill drive tubes were analyzed on an SDS electronic enhancer to determine sedimentary structures in the core samples. The data obtained were compared with all other Apollo mission radiographs and used to make inferences on the character of sedimentary depositional processes on the lunar surface. Author

N77-27053*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LUNAR SAMPLE STUDIES
Washington 1977 72 p refs
(NASA-SP-418) Avail: NTIS HC A04/MF A01 CSCL 03B

Lunar samples discussed and the nature of their analyses are: (1) an Apollo 15 breccia which is thoroughly analyzed as to the nature of the mature regolith from which it derived and the time and nature of the lithification process, (2) two Apollo 11 and one Apollo 12 basalts analyzed in terms of chemistry, Cross-Iddings-Pirsson-Washington norms, mineralogy, and petrography, (3) eight Apollo 17 mare basalts, also analyzed in terms of chemistry, Cross-Iddings-Pirsson-Washington norms, mineralogy, and petrography. The first seven are shown to be chemically similar although of two main textural groups; the eighth is seen to be distinct in both chemistry and mineralogy, (4) a troctolitic clast from a Fra Mauro breccia, analyzed and contrasted with other high-temperature lunar mineral assemblages. Two basaltic clasts from the same breccia are shown to have affinities with rock 14053, and (5) the uranium-thorium-lead systematics of three Apollo 16 samples are determined; serious terrestrial-lead contamination of the first two samples is attributed to bandsaw cutting in the lunar curatorial facility. Author

N77-27054*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN INTERPRETATION OF PHOTOMETRIC PARAMETERS OF BRIGHT DESERT REGIONS OF MARS AND THEIR DEPENDENCE ON WAVE LENGTH
Willard R. Weaver and Willard E. Meador Washington Jun. 1977 19 p refs
(NASA-TN-D-8446; L-11334) Avail: NTIS HC A02/MF A01 CSCL 03B

Photometric data from the bright desert areas of Mars were used to determine the dependence of the three photometric parameters of the photometric function on wavelength and to provide qualitative predictions about the physical properties of the surface. Knowledge of the parameters allowed the brightness of these areas of Mars to be determined for any scattering geometry in the wavelength range of 0.45 to 0.70 micron. The changes that occur in the photometric parameters due to changes in wavelength were shown to be consistent with their physical interpretations, and the predictions of surface properties were shown to be consistent with conditions expected to exist in these regions of Mars. The photometric function was shown to have potential as a diagnostic tool for the qualitative determination of surface properties, and the consistency of the behavior of the photometric parameters was considered to be support for the validity of the photometric function. Author

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N77-27055 Institut d'Aeronomie Spatiale de Belgique, Brussels.
PENETRATION OF SOLAR WIND PLASMA ELEMENTS INTO THE MAGNETOSPHERE
J. Lemaire and M. Roth 1976 21 p refs Presented at the 3d European Geophys. Soc. Meeting, Symp. on Magnetopause Regions, Amsterdam, 7-10 Sep. 1976 Submitted for publication
(Aeronomica-Acta-A-166-1976) Avail: Issuing Activity

Considering that the solar wind is unsteady and non-uniform, it is suggested that field aligned plasma elements dent the magnetopause surface. This indentation makes the magnetopause boundary convex, and therefore locally unstable with respect to flute instabilities. The intruding element is braked and stopped within 1 or 2 earth radii from the magnetopause. Its excess convection kinetic energy is dissipated in the lower polar cusp ionosphere in time lapses of 50 to 500 seconds depending on the value of integrated Pedersen conductivity. Once the plasma element has been engulfed, keeping its identity, the warm plasma content is dissipated by precipitation and by drifting. The magnetosheath particles with large pitch angles are mirrored, and feed the plasma mantle flow. Several consequences of this penetration mechanism are pointed out: ionospheric heating beneath the polar cusp; Birkeland currents on the eastward and westward edges of the plasma element; diamagnetic field fluctuations within 1-2 R sub E from the magnetopause (multiple magnetopause crossings); oscillation of the magnetopause surface after a new element has penetrated; exit of energetic particles out of the magnetosphere, and entry of energetic solar wind particles into the magnetosphere along the magnetic field lines of the intruding element; magnetic flux is substracted from the dayside magnetospere and added to the geomagnetic tail when the magnetic field of the element has a southward component. Author (ESA)

N77-27056*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THREE-DIMENSIONAL RECONSTRUCTION OF OPTICALLY THIN SOLAR EMISSION SOURCES
S. O. Kastner, R. J. Thomas, and C. Wade May 1977 23 p refs
(NASA-TM-X-71341; X-682-77-136) Avail: NTIS HC A02/MF A01 CSCL 03B

Calculations are given for constructing the three dimensional distribution of optically thin EUV emission sources associated with solar active regions, from two dimensional observations (projections) recorded by the spectroheliograph on the OSO 7 satellite. The relation of the method to other image reconstruction methods is briefly discussed as well as the special requirements imposed in the solar case such as a knowledge of the true solar rotation function. A useful correlation criterion for establishing the physical validity of solutions is given. Author

N77-27057# Wisconsin Univ., Madison.
CALCULATION OF MONTHLY AVERAGE INSOLATION ON TILTED SURFACES
S. A. Klein 1976 14 p Presented at Joint Conf. of the Amer. Sect. of the Intern. Solar Energy Soc. and the Solar Energy

Soc. of Canada, Inc., Winnipeg, Manitoba, Can., 15 Aug. 1976 (Contract EY-76-S-02-2588)
(CONF-760842-15) Avail: NTIS HC A02/MF A01

Several simplified design procedures for solar energy systems require monthly average meteorological data. Monthly average daily totals of the solar radiation incident on a horizontal surface are available. However, radiation data on tilted surfaces, required by the design procedures, are generally not available. A simple method of estimating the average daily radiation for each calendar month on surfaces facing directly towards the equator was presented. The method is verified with experimental measurements and extended to allow calculation of monthly average radiation on surfaces of a wide range of orientations. The results are presented in analytic and tabular form for latitudes ranging from 25 deg to 55 deg, surface azimuth angles of + or - 45 deg, and for collector slopes within the range of practical interest. ERA

N77-27058# Brookhaven National Lab., Upton, N.Y. Dept. of Chemistry.
REPORT ON THE BROOKHAVEN SOLAR NEUTRINO EXPERIMENT
R. Davis, Jr. and J. C. Evans, Jr. 1976 17 p refs Presented at the Intern. Seminar on Active Processes on the Sun and the Solar Neutrino Problem, Leningrad, 22 Sep. 1976
(Contract E(30-1)-16)
(BNL-21837; Conf-760973-1) Avail: NTIS HC A02/MF A01

Developments and results of the Brookhaven Solar Neutrino Experiment are discussed on active processes on the sun and the solar neutrino problem. Argon-37 decay events were characterized by the energy of the Auger electrons emitted following the electron capture decay and by the rise-time of the pulse. Counting measurements were continued for a period sufficiently long to observe the decay of Ar-37. ERA

N77-27059# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 389. PART 2: COMPREHENSIVE REPORTS. DATA FOR JULY 1976 - JUNE 1976 AND MISCELLANEA
Hope I. Leighton Jan. 1977 40 p
(PB-264791/5; SGD-389-Pt-2; NOAA-77021405) Avail: NTIS HC A03/MF A01 CSCL 03B

Tables and graphs present data on: active regions, synoptic solar map, solar flares, solar radio waves, energetic solar particles and plasma, abbreviated calendar record, regional flare index and solar radio waves spectral observations. GRA

N77-27060# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 389. PART 1: PROMPT REPORTS. DATA FOR DECEMBER 1976 - NOVEMBER 1976
Hope I. Leighton Jan. 1977 115 p
(PB-264790/7; SGD-389-Pt-1; NOAA-77021404) Avail: NTIS HC A06/MF A01 CSCL 03B

Data obtained by the SMS 2 satellite include: alert periods, daily solar indices, solar flares, solar radio waves, solar wind measurements, solar X-ray radiation, coronal holes, and inferred IP magnetic field polarities for December. Additional information describes the daily solar activity center, sudden ionospheric disturbances, solar radio waves, cosmic rays, geomagnetic indices and radio propagation indices for November. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N77-27061*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
X-RAY AND GAMMA-RAY LINE PRODUCTION BY NONTHERMAL IONS
R. W. Bussard, K. Omidvar, and R. Ramaty Jun. 1977 35 p refs Submitted for publication
(NASA-TM-X-71335; X-660-77-144) Avail: NTIS HC A03/MF A01 CSCL 03B

X-ray production was calculated at approximately 6.8 keV by the 2p to 1s transition in fast hydrogen- and helium-like iron ions, following both electron capture to excited levels and collisional excitation. A refinement of the OBK approximation was used to obtain an improved charge exchange cross section. This, and the corresponding ionization cross section were used to determine equilibrium charge fractions for iron ions as functions of their energy. The effective X-ray line production cross section was found to be sharply peaked in energy at about 8 to 12 MeV/amu. Because fast ions of similar energies can also excite nuclear levels, the ratio of selected strong gamma ray line emissivities to the X-ray line emissivity was also calculated. Limits set by this method on the intensity of gamma ray line emission from the galactic center and the radio galaxy Centaurus A are generally lower than those reported in the literature. Author

N77-27062# Kiel Univ. (West Germany). Inst. fuer Reine und Angewadte Kernphysik.
AN EXTENDED SET OF COSMIC RAY VARIATIONAL COEFFICIENTS FOR EUROPEAN COSMIC RAY STATIONS
O. H. Binder, M. A. Shea (AFGL), and D. F. Smart (AFGL) 3 Mar. 1977 114 p refs
(AF Proj. 2311)
(AD-A036992; IFKKI-76/11; AFGL-TR-77-0057) Avail: NTIS HC A06/MF A01 CSCL 04/1

Variational coefficients quantitatively relate cosmic-ray spatial anisotropies and spectral changes to variations in ground-based cosmic ray monitor counting rates. We have calculated variational coefficients that are applicable to the analysis of a wide variety of transient cosmic ray phenomena. These calculations have been made for (1) a wide range of upper limiting rigidities from 29 to 500 GV; (2) power law rigidity spectra extending to exponents as high as +1.6; (3) spatial profiles independent of latitude; and (4) longitudinal profiles including square waves of 10, 30, 60 and an isotropic case. These variational coefficients have been calculated for eleven European cosmic ray stations, the tables being compatible with a previous publication for stations in the Western Hemisphere. Author (GRA)

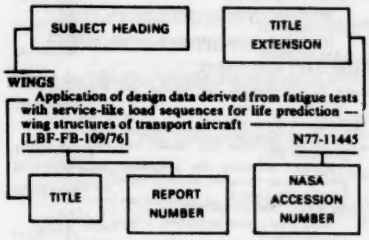
99 GENERAL

N77-27063*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AMES RESEARCH CENTER PUBLICATIONS, 1975
Betty R. Sherwood, comp. May 1977 158 p refs
(NASA-TM-X-73245; A-7048) Avail: NTIS HC A08/MF A01 CSCL 05B

This bibliography cites 851 documents by Ames Research Center personnel and contractors which appeared in formal NASA publications, journals, books, patents, and contractor reports in 1975, or not included in previous annual bibliographies. An author index is provided. Author

SUBJECT INDEX

Typical Subject Index Listing



The subject heading is the key to the subject content of the document. Titles, report numbers, and accession numbers of pertinent documents are provided under each subject heading. When the title is insufficiently descriptive of the document content, a title extension has been added, separated from the title by three hyphens. The report number helps to indicate the type of document cited (e.g., NASA report, NASA translation, NASA contractor report). The NASA accession number is the number by which the document abstracts are arranged in this journal and by which the document is sold or requested. The titles, with title extensions if present, are arranged under each subject heading in ascending accession number order. The subject headings have been selected from the latest revision of the *NASA Thesaurus* (NASA SP-7050).

A

A-10 AIRCRAFT
A comparison of the USAF projected A-10 employment in Europe and the Luftwaffe Schlachtgeschwader experience on the eastern front in World War II
[AD-A036863] N77-26125
ACCELERATED LIFE TESTS
Preliminary results of accelerated exposure testing of solar cell system components
[NASA-TM-X-73674] N77-26615
ACCELERATION TOLERANCE
Effects of direct side force control on pilot tracking performance
[AD-A036083] N77-26812
ACCUMULATORS
An integrated circuit floating point accumulator
[NASA-TN-D-8509] N77-27046
ACCURACY
Meteorological data, series A monographs. Volume 1, no. 2: Accuracy of locating distant thunderstorm centers with Heinrich Hertz Institute's VLF atmospherics analyzer
N77-26768
Accuracy property of certain hyperbolic difference schemes
[SAND-76-0389] N77-26838
ACOUSTIC EMISSION
Space shuttle response to acoustic combustion instability in the solid rocket boosters
[AD-A037157] N77-26200
ACOUSTICS
Development of spectrophones for CW and pulsed radiation sources
[AD-A035594] N77-26489
ACQUISITION
Acquisition and activity in aged rats
[MBL-1976-4] N77-26789
ACTIVITY [BIOLOGY]
Acquisition and activity in aged rats
[MBL-1976-4] N77-26789
ACTUATORS
Multiple-actuator shaker digital control system
[UCRL-78340] N77-26543
ADAPTIVE CONTROL
Wind tunnel wall effects — adaptive flow distribution
[AD-A037532] N77-26103
ADAPTIVE FILTERS
Principles and applications of adaptive filters: A tutorial review
[AD-A037755] N77-26357
Evaluation of an adaptive filter as a digital tracking filter
[SAND-76-5668] N77-26396
Laser pointing and tracking using an adaptive extended Kalman filter
[AD-A035275] N77-26496
ADDITIVES
Impurity effects on the creep of polycrystalline magnesium and aluminum oxides at elevated temperatures
[COO-1591-31] N77-26996
ADHESION
Research on coatings or surface treatment of metal powders
[AD-A036870] N77-26298
ADHESIVE BONDING
Adhesive bonded aerospace structures standardized repair handbook
[AD-A035601] N77-26072
Nonlinear analysis of bonded joints with thermal effects
[NASA-CR-153263] N77-26534
ADHESIVES
Lap shear strength of selected adhesives [epoxy, varnish, B-stage glass cloth] in liquid nitrogen and at room temperature
[ORNL/TM-5658] N77-26312
ADIABATIC CONDITIONS
Applying the reciprocity principle to solving heat conductivity problems
[AD-A037450] N77-26427
Application of the equivalency principle to the solution of heat conductivity problems
[AD-A037584] N77-26428
AERIAL EXPLOSIONS
Air blast effects on concrete walls
[ANL-CT-76-50] N77-26540
AERIAL PHOTOGRAPHY
Remote sensing in Michigan for land resource management
[NASA-CR-153392] N77-26578
Applications of remote sensing to estuarine management
[NASA-CR-153287] N77-26585
Remote sensing of wetlands
[NASA-CR-153282] N77-26588
AERODYNAMIC CHARACTERISTICS
Estimation at subsonic speeds of the longitudinal and lateral aerodynamic characteristics of wing-body combinations at angles up to 90 deg
[WRE-REPT-1672(WR/D)] N77-26080
Investigation of real-gas and viscous effects on the aerodynamic characteristics of a 40 deg half-cone with suggested correlations for the shuttle orbiter
[NASA-TN-D-8418] N77-26081
Airframe, wing, and tail aerodynamic characteristics of a 1/6-scale model of the rotor systems research aircraft with the rotors removed
[NASA-TN-D-8456] N77-26082
The aerodynamic characteristics of wrap-around fins at Mach numbers of 0.3 to 3.0
[AD-A036715] N77-26086
Static, noise, and transition tests of a combined-surface-blowing V/STOL lift/propulsion system
[NASA-CR-151954] N77-26139
AERODYNAMIC CONFIGURATIONS
Aerodynamic configuration development of the highly maneuverable aircraft technology remotely piloted research vehicle
[NASA-CR-143841] N77-26076
A summary of jet plume effects on the stability characteristics of a body of revolution with various fin configurations at Mach numbers from 0.2 to 2.3 normal jet plume simulator
[AD-A037356] N77-26084
An experimental investigation using a normal jet plume simulator to determine jet plume effects on a long slender rocket configuration at Mach numbers from 0.2 to 1.5
[AD-A037735] N77-26093
AERODYNAMIC FORCES
Laboratory verification of force determination, a potential tool for reliability testing
[AD-A035960] N77-26523
AERODYNAMIC HEAT TRANSFER
Results of phase change paint heat transfer test utilizing 0.040-scale 50% forebody models [no. 82-0] of the Rockwell International Space Shuttle Orbiter in AEDC VKF hypersonic tunnel B [test OH54B]
[NASA-CR-151074] N77-26197
AERODYNAMIC HEATING
Stability and transition in boundary layers on reentry vehicle nosetips
[AD-A035712] N77-26449
AERODYNAMIC INTERFERENCE
Aerodynamic interference of two axisymmetric stores at low supersonic speeds
[AD-A036900] N77-26100
AERODYNAMIC STABILITY
A summary of jet plume effects on the stability characteristics of a body of revolution with various fin configurations at Mach numbers from 0.2 to 2.3 normal jet plume simulator
[AD-A037356] N77-26084
Low-speed V/STOL stability and control prediction. Volume 1: Model description and validation
[AD-A037688] N77-26158
Low-speed V/STOL stability and control prediction. Volume 2: Computer program user manual
[AD-A037689] N77-26159
Stability and transition in boundary layers on reentry vehicle nosetips
[AD-A035712] N77-26449
AERODYNAMIC STALLING
Exploratory investigation of the incipient spinning characteristics of a typical light general aviation airplane
[NASA-TM-X-73671] N77-26153
AERODYNAMICS
Aeronautical engineering: A special bibliography with indexes, supplement 83, May 1977
[NASA-SP-7037[83]] N77-26066
Method for determining atmospheric dispersion conditions from synoptic observations
[ORNL-TR-4230] N77-26735
AEROELASTICITY
Optimum design of composite wing structures with twist constraint for aeroelastic tailoring
[AD-A038029] N77-26099
AEROLOGY
Meteorological data. Volume 142, no. 4: Aerological data, Berlin-Tempelhof, 1974
[QR-4] N77-26767
AERONAUTICAL ENGINEERING
Aeronautical engineering: A special bibliography with indexes, supplement 83, May 1977
[NASA-SP-7037[83]] N77-26066
Aviation simulation master plan, phase 1. Volume 1
[AD-A037803] N77-26172
AERONOMY
Research in Aeronomy
[NASA-CR-153264] N77-26727
AEROSOLS
Multidisciplinary lidar system in Spacelab for application to atmospheric physics and remote sensing — aerosols and trace gases
[BMFT-FB-W-76-23] N77-26597
Aerosol research and development related to health hazards analysis
[LA-6539-PR] N77-26703
Comprehensive aerosol growth model
[BNWL-SA-5931] N77-26706
Comparison of wet chemical and instrumental methods for measuring airborne sulfate
[PB-264201/5] N77-26719
Aerosol physical properties in the stratosphere [APPS] radiometer design
[NASA-CR-145199] N77-26732
Limitation on electrical measures of aerosols
[BNL-21946] N77-26736
A comparison of measured 3.8 micron scattering from naturally occuring aerosols with that predicted by measured particle size statistics
[AD-A038032] N77-26742
AEROSPACE ENGINEERING
AGARD highlights 77/1 — research and development economics, policies, and the space transportation system
N77-26074
AEROSPACE MEDICINE
Studies in neuroendocrine pharmacology
[NASA-CR-153278] N77-26795
AEROSPACE SCIENCES
Investigation of possibilities for solar powered high energy lasers in space
[NASA-CR-153271] N77-26478

AEROSPACEPLANES
Identification of natural frequencies and modal damping ratios of aerospace structures from response data
[NASA-CR-151419] N77-26532
AFTERBODIES
An application of the Chapman-Korst theory to supersonic nozzle-afterbody flows
[AD-A035254] N77-26447
AGING (BIOLOGY)
Acquisition and activity in aged rats
[MBL-1976-4] N77-26789
AGING (MATERIALS)
Air Launch Instrumented Vehicles Evaluation [ALIVE] — aging characteristics
[AD-A037102] N77-26237
AGRICULTURE
Systems study of fuels from sugarcane, sweet sorghum, sugar beets, and corn
[TID-27336] N77-26324
Agriculture aviation study and program plan. Volume 1: Project summary
[NASA-CR-153283] N77-26582
Agriculture aviation study and program plan. Volume 2: Supplemental information
[NASA-CR-153284] N77-26583
LACIE: A look to the future
[NASA-TM-74623] N77-26589
Potential use of power plant reject heat in commercial aquaculture
[ORNL/TM-5663] N77-26662
Bioconversion of agricultural wastes for pollution control and energy conservation
[TID-27164] N77-26675
Meteorology and hydrology in aid of food production
N77-26755
Meteorological service in aid of agricultural production
N77-26757
AIR
Some basic considerations of measurements involving collimated direct sunlight
[NASA-CP-2010] N77-26622
AIR CONDITIONING
Evaluation of initial collector field performance at the Langley Solar Building Test Facility
[NASA-TM-X-73677] N77-26617
Comparative performance of solar heating with air liquid systems
[COO-2868-1] N77-26676
AIR FLOW
A nonlinear vertical-plane mathematical model for air cushion-supported vehicles
[AD-A037062] N77-26095
Prediction of test cell visible emissions
[AD-A037694] N77-26146
The zig zag classifier: A windsifter with a novel classifying principle
[BLL-RTS-10357] N77-26420
AIR LAUNCHING
The flight test aspects of the Air-Launched Balloon System [ALBS] development program
[AD-A037540] N77-26098
Air Launch Instrumented Vehicles Evaluation [ALIVE] — aging characteristics
[AD-A037102] N77-26237
AIR NAVIGATION
Flight test results of the Strapdown hexad Inertial Reference Unit [SIRU]. Volume 1: Flight test summary
[NASA-TM-73163] N77-26111
AIR POLLUTION
In situ measurements of Arctic atmospheric trace constituents from an aircraft
[NASA-TN-D-8491] N77-26701
Direct-inlet mass spectrometer for real-time analysis of particulate contaminants in air
[BNWL-SA-5645] N77-26704
Urban design and public exposure to carbon monoxide
[ANL-76-XX-22] N77-26707
Air pollution and the siting of fossil fuel power plants
[ANL-76-XX-14] N77-26708
Robustness of linear estimators to misspecification of trend
[COO-2874-4] N77-26709
Interpolation of air pollution: A stochastic approach
[COO-2874-11] N77-26710
Short- and long-term dispersion factors for calculating the environmental burden due to exhaust air streams
[ORNL-TR-4234] N77-26711
Comparison of calculated and measured maximum aboveground air pollutant concentrations and their respective distances from the source of release of large power plants
[ORNL-TR-4231] N77-26712
International Conference on Photochemical Oxidant Pollution and Its Control. Proceedings, volume 1
[PB-264232/0] N77-26717
International Conference on Photochemical Oxidant Pollution and Its Control. Proceedings, volume 2
[PB-264233/8] N77-26718
Comparison of wet chemical and instrumental methods for measuring airborne sulfate
[PB-264201/5] N77-26719
Improvements to single-source model. Volume 1: Time-concentration relationships
[PB-264686/7] N77-26720
Particulate control mobile test units: Second year's operation
[PB-264067/0] N77-26721
A diffusion-deposition scheme for use within the ARL trajectory model
[PB-264788/1] N77-26722
Technical and economic evaluation of NOx control for coal-fired cyclone furnaces
[PB-264642/0] N77-26723
Analytical and experimental assessment of highway impact on air quality
[PB-264590/1] N77-26724
Measurements of background hydrocarbons in remote areas
[AD-A037361] N77-26725
The transport of oxidant beyond urban areas. Compilation of data for the New England study, 1975
[PB-264205/6] N77-26784
Influence of altered gaseous environments on lung metabolism
[AD-A037977] N77-26801
AIR QUALITY
National assessment of the urban particulate problem. Volume 1: Summary of national assessment
[PB-263665/2] N77-26715
National assessment of the urban particulate problem. Volume 2: Particle characterization
[PB-263666/0] N77-26716
AIR TRAFFIC CONTROL
Estimation of UG3RD safety benefits
[AD-A036895] N77-26109
DABS monopulse summary — monopulse azimuth estimation
[AD-A038157/4] N77-26114
System definition and investigation of the on site processing of en route sensor signals. Volume 1: Summary of results, system definition, radar processing
[AD-A038491/7] N77-26115
System definition and investigation of the on site processing of en route sensor signals. Volume 2: Beacon processing investigation
[AD-A038492/5] N77-26116
System definition and investigation of the on site processing of en route sensor signals. Volume 3: Appendices
[AD-A038493/3] N77-26117
An econometric analysis of enroute and terminal air traffic control
[AD-A036892] N77-26119
Communications station evaluation report, Selfridge ANGB, Michigan, 9-18 November 1976
[AD-A037479] N77-26120
AIR TRANSPORTATION
A study of commuter air service
[NASA-CR-152005] N77-26108
Factors affecting the corporate decisionmaking process of air transport manufacturers
[NASA-CR-154618] N77-27020
AIRBORNE EQUIPMENT
Multidisciplinary lidar system in Spacelab for application to atmospheric physics and remote sensing — aerosols and trace gases
[BMFT-FB-W-76-23] N77-26597
In situ measurements of Arctic atmospheric trace constituents from an aircraft
[NASA-TN-D-8491] N77-26701
AIRBORNE SURVEILLANCE RADAR
Performance of coherent-on-receive synthetic aperture side looking airborne radar — for oil slick detection
[AD-A035032] N77-26366
AIRCRAFT ACCIDENT INVESTIGATION
Estimation of UG3RD safety benefits
[AD-A036895] N77-26109
Annual review of aircraft accident data, US air carrier operations, 1975
[PB-264346/8] N77-26110
AIRCRAFT ACCIDENTS
Annual review of aircraft accident data, US air carrier operations, 1975
[PB-264346/8] N77-26110
Development of smoke abated aircraft crash/rescue fire fighting trainer
[AD-A035999] N77-26260
AIRCRAFT CARRIERS
Annual review of aircraft accident data, US air carrier operations, 1975
[PB-264346/8] N77-26110
AIRCRAFT CONTROL
Task-Oriented Flight Control Systems
[AGARD-LS-89] N77-26161
Task-Oriented Flight Control Systems: Introduction and overview — aircraft control
N77-26162
Engineering of control systems and implications on control law design
N77-26163
Implementation of task-oriented control laws
N77-26165
Bibliography on task-oriented flight control systems
N77-26167
AIRCRAFT DESIGN
Task-Oriented Flight Control Systems: Introduction and overview — aircraft control
N77-26162
AIRCRAFT ENGINES
SPAERS: Simulation for the Performance Aircraft Engine Repair Systems
[AD-A035737] N77-26073
Performance, emissions, and physical characteristics of a rotating combustion aircraft engine
[NASA-CR-135119] N77-26134
Integrated engine instrument system, volume 1
[AD-A035565] N77-26143
Integrated engine instrument system, volume 2
[AD-A035566] N77-26144
AIRCRAFT EQUIPMENT
Analysis of flight equipment purchasing practices of representative air carriers
[NASA-CR-154619] N77-27021
AIRCRAFT INDUSTRY
Aircraft industry capacity study
[AD-A037837] N77-26071
Factors affecting the corporate decisionmaking process of air transport manufacturers
[NASA-CR-154618] N77-27020
AIRCRAFT INSTRUMENTS
Integrated engine instrument system, volume 1
[AD-A035565] N77-26143
Integrated engine instrument system, volume 2
[AD-A035566] N77-26144
Description and flight tests of an oculometer
[NASA-TN-D-8419] N77-26154
AIRCRAFT LAUNCHING DEVICES
Evaluation of the Harpoon missile shock environment during ejection launch by aircraft launchers
[AD-A037067] N77-26186
AIRCRAFT MAINTENANCE
Adhesive bonded aerospace structures standardized repair handbook
[AD-A035601] N77-26072
SPAERS: Simulation for the Performance Aircraft Engine Repair Systems
[AD-A035737] N77-26073
AIRCRAFT MANEUVERS
Aerodynamic configuration development of the highly maneuverable aircraft technology remotely piloted research vehicle
[NASA-CR-143841] N77-26076
The need for task oriented control laws
N77-26164
Implementation of task-oriented control laws
N77-26165
AIRCRAFT PARTS
Parametric study of transport aircraft systems cost and weight
[NASA-CR-151970] N77-26106
AIRCRAFT PRODUCTION
Factors affecting the corporate decisionmaking process of air transport manufacturers
[NASA-CR-154618] N77-27020
AIRCRAFT SAFETY
Estimation of UG3RD safety benefits
[AD-A036895] N77-26109
AIRCRAFT STABILITY
Present-day role of control and stability augmentation systems and future trends
[MBB-UFE-1182[O]] N77-26155
AIRCRAFT STRUCTURES
Adhesive bonded aerospace structures standardized repair handbook
[AD-A035601] N77-26072
Effects of laboratory simulated precipitation static electricity and swept stroke lightning on aircraft windshield subsystems
[AD-A037196] N77-26127
AIRCRAFT SURVIVABILITY
Project management of Army aircraft survivability equipment
[AD-A036785] N77-26128
AIRCRAFT WAKES
Analysis of the separated boundary layer flow on the surface and in the wake of blunt trailing edge airfoils
[NASA-CR-145202] N77-26075
AIRFOILS
Advancement of a method for calculating separated flows around airfoils with special consideration of profile drag
[ESA-TT-373] N77-26091
Application of sputter-deposited lamellar composite technology to the development of high temperature turbine blade materials and airfoil fabrication
[AD-A037349] N77-26151
Lift, circulation and pressure distributions for a foil oscillating in pitching motion in a perfect fluid
[UFD-1] N77-26422
AIRFRAME MATERIALS
Determination of the airworthiness of ZPG-3W cotton D621 and the ZPG-2 dacron GDC-5 airship envelopes
[AD-A037548] N77-26096
Electrochemical investigation of galvanic corrosion of aircraft material couples
[DLR-FB-76-61] N77-26288

AIRFRAMES
Damage tolerance of thin skin sandwich panels
[AD-A037526] N77-26539
AIRLINE OPERATIONS
Analysis of flight equipment purchasing practices of representative air carriers
[NASA-CR-154619] N77-27021
AIRSHIPS
Determination of the airworthiness of ZPG-3W cotton D621 and the ZPG-2 dacron GDC-5 airship envelopes
[AD-A037548] N77-26096
ALASKA
Study of Alaskan wind power and its possible applications
[NSF/RANN/SE/AER74-00239/FR-26] N77-26664
A social and economic impact study of offshore petroleum and natural gas development in Alaska, phase 1
[PB-264705/5] N77-26677
A social and economic impact study of offshore petroleum and natural gas development in Alaska, phase 2
[PB-264706/3] N77-26693
ALCOHOLS
Effect of naphthols on the thermal stability of fuels
[NASA-TT-F-17302] N77-26322
ALERTNESS
Alerting in database systems: Concepts and techniques
[AD-A037437] N77-26861
ALGAE
Analysis of laser fluorosensor systems for remote algae detection and quantification
[NASA-TN-D-8447] N77-26480
ALGEBRA
KWIC index for numerical algebra, supplement 1
[ORNL/CSD-18-[SUPPL-1]] N77-26884
ALGORITHMS
Local, regional and large scale
[AD-A03593] N77-26354
Solution of transient problems in free surface hydrodynamics
[AD-A037717] N77-26452
Solution of transient optimization problems by using an algorithm based on nonlinear programming
[NASA-TM-X-73618] N77-26829
Simulation of the performance of a collection of storage space allocation algorithms
[UCID-17251] N77-26834
Two-dimensional delta-mod facsimile coding
[UCRL-77999] N77-26840
A combined Remes-differential correction algorithm for rational approximation
[AD-A037667] N77-26851
Vectorized general sparsity algorithms with backing store
[AD-A037971] N77-26892
Algorithms and hardware technology for image recognition
[AD-A035039] N77-26949
A computerized traffic control algorithm to determine optimal traffic signal settings
[NASA-TM-X-73607] N77-27035
ALKALI HALIDES
Growth of pure single crystals of alkali halides and alkaline earth fluoride
[AD-A037795] N77-27014
ALKALINE EARTH COMPOUNDS
Growth of pure single crystals of alkali halides and alkaline earth fluoride
[AD-A037795] N77-27014
ALKENES
Electroinitiated polymerization of monomers on metal electrodes
[AD-A036989] N77-26321
Environmental considerations of selected energy conserving manufacturing process options. Volume 6: Olefins industry report
[PB-264272/6] N77-26683
ALLOYS
Properties and structure of polymeric alloys
[AD-A037240] N77-26318
ALUMINUM
Study of corrosion and its control in aluminum solar collectors
[COO-2934-76-1] N77-26673
Environmental considerations of selected energy conserving manufacturing process options. Volume 8: Alumina/aluminum industry report
[PB-264274/2] N77-26685
ALUMINUM ALLOYS
Flaw growth of 7075, 7475, 7050 and 7049 aluminum alloy plate in stress corrosion environments
[NASA-CR-150313] N77-26272
Fundamental investigation of fatigue crack growth retardation in aluminum alloys
[AD-A037184] N77-26295
Effects of microstructure on fatigue crack growth of high-strength aluminum alloys
[AD-A037156] N77-26300
Microstructure and mechanical properties of product from extrusion-consolidated 7075 Al prealloyed powder
[AD-A037188] N77-26301
Casting warpage study
[BDX-613-1368] N77-26514
Model analysis for penetration of spaced armor
[AD-A035460] N77-26520
Fatigue resistance of welded joints in AlMg5 subjected to bending N77-26552
Data on the fatigue resistance of welded joints Al Mg5, volume 1
[REPT-76-4-VOL-1] N77-26554
Fatigue behavior of welded joints in Al Zn Mg1, Al Zn4 Mg1, and Al Mg Si [tables and diagrams]
[REPT-76-5-VOL-2] N77-26555
ALUMINUM BORON COMPOSITES
Boron/aluminum fan blades for SCAR engines
[NASA-CR-135184] N77-26135
Influence of temper condition on the nonlinear stress-strain behavior of boron-aluminum
[NASA-TM-X-74753] N77-26271
ALUMINUM OXIDES
The coplanar electron tube
[AD-A037138] N77-26391
Environmental considerations of selected energy conserving manufacturing process options. Volume 8: Alumina/aluminum industry report
[PB-264274/2] N77-26685
Impurity effects on the creep of polycrystalline magnesium and aluminum oxides at elevated temperatures
[COO-1591-31] N77-26996
AMAZON REGION [SOUTH AMERICA]
Application of remote sensing techniques for the study and evaluation of natural resources in Peru — northern Amazon jungle, Ica City, and Nazca lines
[E77-10172] N77-26574
AMMONIA
Environmental considerations of selected energy conserving manufacturing process options. Volume 7: Ammonia industry report
[PB-264273/4] N77-26684
AMORPHOUS MATERIALS
Symposium on the structure of non-crystalline materials
[AD-A037948] N77-27012
AMPLIFIERS
Application and performance of rare gas oxide amplifiers
[UCRL-78483] N77-26484
ANAEROBES
Fast production of methane by anaerobic digestion
[COO-2900-6] N77-26656
ANALOG COMPUTERS
Extended system modelling program - ESMP. Simulation of a large analogue computer on a PDP 11
[OUEL-1178/76] N77-26843
ANALOG TO DIGITAL CONVERTERS
System definition and investigation of the on site processing of en route sensor signals. Volume 1: Summary of results, system definition, radar processing
[AD-A038491/7] N77-26115
System definition and investigation of the on site processing of en route sensor signals. Volume 2: Beacon processing investigation
[AD-A038492/5] N77-26116
System definition and investigation of the on site processing of en route sensor signals. Volume 3: Appendices
[AD-A038493/3] N77-26117
ANALYSIS [MATHEMATICS]
Optimal prefiltering for spline reconstruction
[AD-A037504] N77-26891
Mathematical investigations of dynamical systems
[AD-A036771] N77-26895
ANALYTIC FUNCTIONS
Constructive function theoretic methods for higher order pseudoparabolic equations
[AD-A037671] N77-26889
ANGLE OF ATTACK
Estimation at subsonic speeds of the longitudinal and lateral aerodynamic characteristics of wing-body combinations at angles up to 90 deg
[WRE-REPT-1672[WR/D]] N77-26080
Unsteady two-dimensional wing flow at large control surface angles
[MBB-UFE-1183[O]] N77-26089
ANNEALING
Analysis of the friction behavior at high sliding velocities and pressure for gilding metal, annealed iron, copper and projectile steel
[AD-A035674] N77-26521
ANNUAL VARIATIONS
Classification of coastal environments
[AD-A036770] N77-26750
ANNULAR FLOW
The calculation of two phase pressure drop by means of an annular flow model
[OUEL-1181/77] N77-26442
ANORTHOSITE
Lunar sample studies — breccias basalts, and anorthosites
[NASA-SP-418] N77-27053
ANTENNA ARRAYS
Antennas and central HF cabling — radio interferometer for satellite orbit determination N77-26209
ANTENNA DESIGN
Planning of the interferometer antenna N77-26208
Antennas and central HF cabling — radio interferometer for satellite orbit determination N77-26209
ANTENNA RADIATION PATTERNS
Effect of CW-396A radome on the radiation pattern of rectangular antennas
[AD-A036960] N77-26355
The complete electromagnetic fields in the focal region of a paraboloidal reflector
[AD-A035052] N77-26364
ANTENNAS
Effects of antenna elevation and inclination on VLF/LF signal structure
[AD-A035510] N77-26365
Antenna select computer program [ANTSEL]
[AD-A036737] N77-26381
ANTIBODIES
Isolation of antibody forming cells by using cluster formation in combination with velocity sedimentation
[MBL-1976-6] N77-26790
ANTIINFECTIVES AND ANTIBACTERIALS
Determination of antimicrobial susceptibilities of infected urines without isolation
[NASA-CASE-GSC-12046-1] N77-26797
ANTIREFLECTION COATINGS
Intrinsic and thermal stress modeling for thin-film multilayers
[AD-A035513] N77-26493
APERTURES
The singularity expansion representation of the transient electromagnetic coupling through a rectangular aperture
[AD-A036999] N77-26374
The singularity expansion representation of the transient electromagnetic coupling through a rectangular aperture
[AD-A037353] N77-26375
APOLLO FLIGHTS
Summary of lightning activities by NASA for the Apollo Soyuz test project: Supplement no. 1 to Apollo Soyuz mission evaluation report
[NASA-TM-74755] N77-26729
APOLLO SOYUZ TEST PROJECT
Summary of lightning activities by NASA for the Apollo Soyuz test project: Supplement no. 1 to Apollo Soyuz mission evaluation report
[NASA-TM-74755] N77-26729
APOLLO 15 FLIGHT
Radiographic analysis of sedimentary structures and depositional histories in Apollo 15 cores
[NASA-CR-153265] N77-27052
APPLICATIONS OF MATHEMATICS
Calculator controlled strain gage data acquisition system
[SAND-76-0146] N77-26467
Transactions of the 22nd Conference of Army Mathematicians
[AD-A037211] N77-26886
APPROACH CONTROL
Flight test evaluation of Slant Visual Range/Approach Light Contact Height [SVR/ALCH] measurement system
[AD-A038183/0] N77-26113
APPROACH INDICATORS
Flight test evaluation of Slant Visual Range/Approach Light Contact Height [SVR/ALCH] measurement system
[AD-A038183/0] N77-26113
APPROXIMATION
Approximations for terms related to the kernel in thin-wire integral equations
[AD-A036729] N77-26416
A combined Remes-differential correction algorithm for rational approximation
[AD-A037667] N77-26851
Best rational approximations with negative poles to e to the -x power on [0, infinity]
[AD-A037559] N77-26888
ARC DISCHARGES
Experiments with a large sized hollow cathode discharge, part 3 — plasma rotation
[TH-76-E-67] N77-26986
ARC JET ENGINES
Determination of the excited state density distribution within a nonequilibrium, freely expanding argon arcjet plume
[AD-A037352] N77-26145
ARC WELDING
Irradiated dynamic fracture toughness of ASTM A533 grade B, class 1 steel plate and submerged arc weldment
[ORNL/SUB-3720-1] N77-26274
ARCHITECTURE [COMPUTERS]
An architectural approach to X25 N77-26856
Towards a unified view of high level protocols N77-26857
Terminal access protocols on EURONET N77-26858

ARCTIC REGIONS
In situ measurements of Arctic atmospheric trace constituents from an aircraft
[NASA-TN-D-8491] N77-26701
ARGON
Nuclear pumped laser II
[NASA-CR-153292] N77-26479
ARGON LASERS
Experimental determination of the contrast of two interfering argon laser beams — laser anemometer development
[ISL-R-116/76] N77-26490
A laser Raman system for obtaining N2 and CO2 concentrations in probe-sampled combustion gases
[AD-A037563] N77-26502
ARMED FORCES [UNITED STATES]
Update to reliability and maintainability planning guide for Army aviation systems and components
[AD-A037446] N77-26528
Study of US Army libraries. Volume 2: Directory
[AD-A036002] N77-27028
Study of US Army libraries, volume 1 — management methods
[AD-A036004] N77-27033
ARMOR
Model analysis for penetration of spaced armor
[AD-A035460] N77-26520
An improved method of determining shock test specifications for fire control equipment
[AD-A037618] N77-26538
ARTIFICIAL INTELLIGENCE
Forward reasoning and dependency-directed backtracking in a system for computer-aided circuit analysis
[AD-A035719] N77-26411
An assessment of reliability of dialogue annotation instructions
[AD-A037109] N77-26874
Overview of a linguistic theory of design
[AD-A036977] N77-26876
Report of the 1976 Joint Workshop on Pattern Recognition and Artificial Intelligence
[AD-A037503] N77-26878
ACS. 1: An experimental management tool
[AD-A037311] N77-27023
ARTIFICIAL SATELLITES
On-orbit performance of the 12 GHz, 200 watt transmitter experiment package for CTS
[NASA-TM-X-73636] N77-26183
ASTRONOMICAL TELESCOPES
Design study of the accessible focal plane telescope for shuttle
[NASA-CR-151440] N77-26943
ASTRONOMY
Infrared upconversion for astronomy
[NASA-CR-153393] N77-27047
ASYMPTOTIC SERIES
Asymptotic representation of Stirling numbers of the second kind
[AD-A035713] N77-26896
ATMOSPHERES
Conversion of tritiated hydrogen to water in the atmosphere
[BNWL-2113] N77-26737
ATMOSPHERIC ATTENUATION
Laser atmospheric absorption studies
[AD-A036872] N77-26500
DF laser propagation analysis
[AD-A037813] N77-26501
ATMOSPHERIC CHEMISTRY
Research in Aeronomy
[NASA-CR-153264] N77-26727
Water vapor, nitric acid and ozone mixing ratio height profiles derived from spectral radiometric measurements
[AD-A037375] N77-26738
Atmospheric cloud physics thermal systems analysis
[NASA-CR-150312] N77-26753
ATMOSPHERIC CIRCULATION
Method for determining atmospheric dispersion conditions from synoptic observations
[ORNL-TR-4230] N77-26735
ATMOSPHERIC COMPOSITION
In situ measurements of Arctic atmospheric trace constituents from an aircraft
[NASA-TN-D-8491] N77-26701
ATMOSPHERIC CONDUCTIVITY
Limitation on electrical measures of aerosols
[BNL-21946] N77-26736
ATMOSPHERIC DIFFUSION
Comparison of calculated and measured maximum aboveground air pollutant concentrations and their respective distances from the source of release of large power plants
[ORNL-TR-4231] N77-26712
A diffusion-deposition scheme for use within the ARL trajectory model
[PB-264788/1] N77-26722
ATMOSPHERIC EFFECTS
Effect of atmospheric parameters on silicon cell performance
[NASA-CP-2010] N77-26619
Sensitivity of solar-cell performance to atmospheric variables. 1: Single cell
[NASA-CP-2010] N77-26623
Sensitivity of solar-cell performance to atmospheric variables. 2: Dissimilar cells at several locations
[NASA-CP-2010] N77-26624
Effects of atmospheric variability on energy utilization and conservation
[COO-1340-52] N77-26646
ATMOSPHERIC MODELS
Monte Carlo analysis of uncertainty propagation in a stratospheric model. 2: Uncertainties due to reaction rates
[NASA-TM-X-71339] N77-26349
An examination of turbulent dissipation in the marine boundary layer
[AD-A035706] N77-26783
A mathematical study of a random process proposed as an atmospheric turbulence model
[NASA-CR-145200] N77-26897
ATMOSPHERIC SCATTERING
Results from circumsolar radiation measurements
[LBL-5292] N77-26657
A comparison of measured 3.8 micron scattering from naturally occuring aerosols with that predicted by measured particle size statistics
[AD-A038032] N77-26742
ATMOSPHERIC TEMPERATURE
Measurement of growth, measurement and bidirectoral scattering parameters of wheat
[NASA-CR-151351] N77-26592
ATMOSPHERIC TURBULENCE
A mathematical study of a random process proposed as an atmospheric turbulence model
[NASA-CR-145200] N77-26897
A sensitive infrared imaging up converter and spatial coherence of atmospheric propagation
[NASA-CR-149891] N77-27048
ATMOSPHERICS
Meteorological data, series A monographs. Volume 1, no. 2: Accuracy of locating distant thunderstorm centers with Heinrich Hertz Institute's VLF atmospherics analyzer
N77-26768
ATOMIC BEAMS
The kinetics of neutrals produced during the injection of an atom beam into the plasma
[BLL-CTO-1284-[9091.9F]] N77-26972
ATOMIC ENERGY LEVELS
Theoretical research in physics of highly ionized atoms
[COO-2557-1] N77-26931
ATOMIC EXCITATIONS
Two photon excitation of atomic oxygen
[NASA-TM-X-71344] N77-26926
ATOMIC PHYSICS
Accelerator based atomic physics experiments: An overview
[CONF-761059-6] N77-26932
ATOMIC STRUCTURE
Electronic structure of metals and semiconductors: Bulk, surface, and interface properties
[LBL-5493] N77-26992
ATTACK AIRCRAFT
A-6E systems approach to training, phase I
[AD-A037468] N77-26803
ATTITUDE CONTROL
Assessment of relative velocity as independent variable for space shuttle first stage guidance attitude command tables
[NASA-CR-151436] N77-26199
AUSTRALIA
Land development in the Daly Basin
[E77-10155] N77-26570
Land development in the Daly Basin
[E77-10156] N77-26571
AUTOMATIC CONTROL
Technical details of the control and drive systems — radio interferometer antennas
N77-26207
Automatic computer controlled operation of the interferometer installation — satellite orbit determination
N77-26212
Vehicle follower longitudinal control for automated guideway transit vehicles
[PB-264554/7] N77-27044
AUTOMATIC PICTURE TRANSMISSION
Meteorological data, series B basic material. Volume 5, no. 3: European climatology 1975. Weather satellite data received in the Berlin area, part 3 — ESSA 8 daily APT data
[QR-3-PT-3] N77-26772
AUTOMOBILES
Construction of the three-dimensional numerical model of an automotive wheel hub
N77-26518
AVIONICS
Flight test results of the Strapdown hexad Inertial Reference Unit [SIRU]. Volume 1: Flight test summary
[NASA-TM-73163] N77-26111
Digital Avionics Information System [DAIS]: Current maintenance task analysis
[AD-A035683] N77-26132
Avionics evaluation program: Multiple aircraft, multiple sorties and cost accumulation
[AD-A037195] N77-26133
Aeronautical systems technology needs. Test facilities and test equipment
[AD-A035252] N77-26171
Update to reliability and maintainability planning guide for Army aviation systems and components
[AD-A037446] N77-26528
Agriculture aviation study and program plan. Volume 1: Project summary
[NASA-CR-153283] N77-26582
Agriculture aviation study and program plan. Volume 2: Supplemental information
[NASA-CR-153284] N77-26583
AXIAL FLOW
An approach to low noise axial flow fan design, manufacture and testing
N77-26922
AXIAL LOADS
Parametric analysis of the stresses in a cruciform axially loaded welded joint
[REPT-76-3] N77-26553
Exponential Fourier densities on a Riemannian metric and optimal estimation for axial processes
[AD-A037505] N77-26914
AXISYMMETRIC BODIES
Aerodynamic interference of two axisymmetric stores at low supersonic speeds
[AD-A036900] N77-26100
Approximate method for strength analysis of circular axially symmetric plates of variable thickness, with ribs on one side and subject to an axially symmetric load
[BLL-RTS-10426] N77-26531
AZIMUTH
DABS monopulse summary — monopulse azimuth estimation
[AD-A038157/4] N77-26114

B

BACKSCATTERING
A comparison of measured 3.8 micron scattering from naturally occuring aerosols with that predicted by measured particle size statistics
[AD-A038032] N77-26742
BACTERIOLOGY
Determination of antimicrobial susceptibilities of infected urines without isolation
[NASA-CASE-GSC-12046-1] N77-26797
BALLOON SOUNDING
Skyhook 1976
[AD-A037419] N77-26094
BALLOONS
The flight test aspects of the Air-Launched Balloon System [ALBS] development program
[AD-A037540] N77-26098
BAND STRUCTURE OF SOLIDS
Electronic energy levels in imperfect solids
[AD-A035723] N77-27017
BANDPASS FILTERS
Computer-aided analysis of electronic filters
[ESA-TM-171] N77-26399
A digital detector with selectable passband
[AD-A035604] N77-26409
BAROCLINITY
Variational energy principle for compressible, baroclinic flow. 2: Free-energy form of Hamilton's principle
[NASA-TM-X-71343] N77-26425
BARRELS [CONTAINERS]
Numerical simulation of natural convection in closed containers using a fully implicit method
[DP-MS-75-127] N77-26431
BASALT
Application of standard photogeologic techniques to LANDSAT imagery for mineral exploration in the basin and range province of Utah and Nevada
[E77-10170] N77-26572
Characterization and distribution of lunar mare basalt types using remote sensing techniques
[NASA-CR-153267] N77-27051
Lunar sample studies — breccias basalts, and anorthosites
[NASA-SP-418] N77-27053
BEADS
Break-up dynamics of polymer beads under laser bombardment
[AD-A037718] N77-26309
BEAMS [SUPPORTS]
Laminated beams: Deflection and stress as a function of epoxy shear modulus
[PPPL-1287] N77-26313
The stability of a beam subjected to a moving mass
[AD-A037719] N77-26566
BEARING [DIRECTION]
Computerized determination of the satellite direction — for orbit determination using radio interferometer
N77-26214

BENDING FATIGUE
Fatigue resistance of welded joints in AlMg5 subjected to bending
N77-26552
BIBLIOGRAPHIES
Aeronautical engineering: A special bibliography with indexes, supplement 83, May 1977
[NASA-SP-7037[83]] N77-26066
Bibliography on task-oriented flight control systems
N77-26167
Electrostatic changing and discharge phenomena observed in geosynchronous orbit. A bibliography
[ONERA-DERTS-NT-03-11] N77-26388
Cybernetics: An overview
[AD-A037993] N77-26877
Ames research center publications, 1975
[NASA-TM-X-73245] N77-27063
BINARY STARS
OSO-8 X-ray observations of AM Herculis
[NASA-TM-X-71313] N77-27050
BIOASSAY
Determination of antimicrobial susceptibilities of infected urines without isolation
[NASA-CASE-GSC-12046-1] N77-26797
BIOINSTRUMENTATION
Investigation on the saturation and clearance of hydrogen gas in the brain and extremities of man, and investigations on biomedical monitoring of divers in wet-suits
[AD-A037498] N77-26800
BIOLOGICAL EFFECTS
Biological effects of negative pions
[LA-UR-76-2529] N77-26799
BIT SYNCHRONIZATION
Hardware simulation of KU-band spacecraft receiver and bit synchronizer, phase 2, volume 1 --- for space shuttle
[NASA-CR-151439] N77-26348
BLOOD
Oxime therapy and oxime blood levels in rats: Dependence on the dose of the organophosphate
[MBL-1976-7] N77-26791
BLOWING
Static, noise, and transition tests of a combined-surface-blowing V/STOL lift/propulsion system
[NASA-CR-151954] N77-26139
BLUNT BODIES
Analysis of the separated boundary layer flow on the surface and in the wake of blunt trailing edge airfoils
[NASA-CR-145202] N77-26075
The problem of a blunt body in a rarefied supersonic flow
[REPT-75-3] N77-26088
Numerical integration of the governing equations for the domain of pure supersonic flows --- at pointed or blunt bodies
[ESA-TT-380] N77-26092
The numerical computations of supersonic flow past blunt bodies
[AD-A037665] N77-26105
A finite difference scheme for the calculation of supersonic three dimensional flow fields around blunt bodies
[ESA-TT-366] N77-26445
BOATS
Personal flotation devices research, phase 1
[AD-A037221] N77-26810
BODIES OF REVOLUTION
A summary of jet plume effects on the stability characteristics of a body of revolution with various fin configurations at Mach numbers from 0.2 to 2.3 normal jet plume simulator
[AD-A037356] N77-26084
The theoretical and experimental dynamic analysis of thin shells of revolution --- using finite element method
N77-26557
BODY-WING AND TAIL CONFIGURATIONS
Airframe, wing, and tail aerodynamic characteristics of a 1/6-scale model of the rotor systems research aircraft with the rotors removed
[NASA-TN-D-8456] N77-26082
BODY-WING CONFIGURATIONS
Estimation at subsonic speeds of the longitudinal and lateral aerodynamic characteristics of wing-body combinations at angles up to 90 deg
[WRE-REPT-1672[WR/D]] N77-26080
BOILERS
Examination of a failed transition weld joint and the associated base metals
[ORNL-5223] N77-26278
Energy Conversion Alternatives Study (ECAS), Phase 2. Volume 3: Summary and advanced steam plant with pressurized fluidized bed boilers
[NASA-CR-134942-VOL-3] N77-26630
BOILING
Calculation of the heat transfer to boiling refrigerators
[BLL-RTS-9959] N77-26418
BOOSTER ROCKET ENGINES
Space shuttle response to acoustic combustion instability in the solid rocket boosters
[AD-A037157] N77-26200
BORON
Spectrophotometric determination of boron in cobalt and nickel coatings by use of carminic acid
[AD-A037344] N77-26293
Electron microscope study of defects in annealed boron implanted silicon
[AD-A037956] N77-27006
BORON FLUORIDES
Boron trifluoride coatings for thermoplastic materials
[NASA-CASE-ARC-11057-1] N77-26308
BOUNDARY LAYER SEPARATION
Analysis of the separated boundary layer flow on the surface and in the wake of blunt trailing edge airfoils
[NASA-CR-145202] N77-26075
BOUNDARY LAYER TRANSITION
Stability and transition in boundary layers on reentry vehicle nosetips
[AD-A035712] N77-26449
Transition in a boundary layer and in a pipe flow
[AD-A037664] N77-26453
BOUNDARY LAYERS
An experimental study of the atmospheric boundary layer modified by a change in surface roughness and surface temperature
[NASA-CR-141422] N77-26730
An examination of turbulent dissipation in the marine boundary layer
[AD-A035706] N77-26783
BOUNDARY VALUE PROBLEMS
The influence of boundary point procedures on accuracy and efficiency in flow field calculations
[DOC-77SDR016] N77-26424
BRAYTON CYCLE
Preliminary Failure Modes, Effects and Criticality Analysis [FMECA] of the Conceptual Brayton Isotope Power System [BIPS] flight system
[TID-27251] N77-26643
Braxton isotope power system. Phase 1: [Ground demonstration system] Configuration Control Document [CCD]
[TID-27252] N77-26644
Zirconia-foil compatibility test. Phase 1
[TE-4219-28-77] N77-26645
Supplement ERDA BIPS preliminary design review
[TID-27270] N77-26667
BRECCIA
Lunar sample studies --- breccias basalts, and anorthosites
[NASA-SP-418] N77-27053
BREMSSTRAHLUNG
Hot electron production, anomalous absorption, and effect of intense electromagnetic fields on inverse bremsstrahlung absorption near the electron plasma frequency
[LA-UR-76-1951] N77-26982
BRIGHTNESS TEMPERATURE
Microwave radiometer theory and measurements of sea ice characteristics
[REPT-S-89] N77-26600
BRINES
Electroless-nickel plating of a large turbine rotor for the geothermal program
[UCID-17253] N77-26286
BROADBAND
The effects of periodic cable defects upon the transmission of wideband signals
[BLL-TRANS-3433-[9022.81]] N77-26344
Study, tests, and evaluation for wideband high-density data acquisition [WHIDDA]
[AD-A037410] N77-26822
BROADCASTING
Development of a klystron for satellite operation in the 12 GHz frequency band
[BMFT-FB-W-76-24] N77-26358
BUBBLES
Wall pressure fluctuations in a bubbly flow
[OUEL-1157/76] N77-26440
BUCKLING
Buckling analysis of ship plate-structures --- using NASTRAN program
[REPT-207-S] N77-26547
BUILDINGS
Solar dwelling design concepts
[HUD-PDR-156[2]] N77-26639
General Electric Company survey to define impact of statewide building codes on solar HVAC systems, commercial buildings. National Solar Demonstration Program
[COO-2683-76-11] N77-26674

C

C-2 AIRCRAFT
Fatigue investigation of the C-2A nose landing gear
[AD-A037901] N77-26126
CADMIUM TELLURIDES
High pressure furnace growth of mercury cadmium telluride
[AD-A036918] N77-26294
Low-frequency noise in [HG, CD] TE detectors
[AD-A037185] N77-27005
CALCULUS OF VARIATIONS
Integral functionals, normal integrands and measurable selections
[AD-A037561] N77-26882
CALIBRATING
Radar range calibrator system evaluation report
[AD-A037134] N77-26179
Calibration of the interferometer --- satellite orbit determination system
N77-26215
Consideration of design and calibration of terrestrial reference solar cells
[NASA-CP-2010] N77-26621
CALIFORNIA
Workshop report integrating Water quality and Water and Land Resources Planning
[PB-263476/4] N77-26601
Water resources data for California, 1975. Volume 1: Colorado River basin, southern great basin from Mexican border to Mono Lake Basin, and Pacific slope basins from Tijuana River to Santa Maria River
[PB-264474/8] N77-26602
Water resources data for California, 1975. Volume 2: Pacific slope basins from Arroyo Grande to Oregon State line except Central Valley
[PB-264475/5] N77-26603
Water resources data for California, 1975. Volume 3: Southern Central Valley Basins and the Great Basin from Walker River to Truckee River
[PB-264476/3] N77-26604
Water resources data for California, 1975. Volume 4: Northern Central Valley Basins and the Great Basin from Honey Lake Basin to Oregon State line
[PB-264477/1] N77-26605
Resurvey of site stability quadrilaterals, Otay Mountain and Quincy, California --- San Andreas fault experiment
[NASA-CR-149155] N77-26728
CALORIMETERS
Thermal radiative losses from graphite calorimeters used in pulsed electron beam experiments
[AD-A037754] N77-26475
CAMERA TUBES
Development study for a high accuracy star sensor. Volume 1: Study and development of an outline concept --- noting camera tubes and CCD
[ESA-CR[P]-923-VOL-1] N77-26945
CAMERAS
Clinical high-purity germanium gamma-camera
[UCRL-78132] N77-26461
CANARD CONFIGURATIONS
The effectiveness of canards for roll control
[AD-A037077] N77-26160
CANCER
A cervix-to-rectum measuring device in a radiation applicator for use in the treatment of cervical cancer
[NASA-CASE-GSC-12081-2] N77-26796
CANS
Study on the feasibility of structural thermal canister for the instrument pointing sub-system of the Spacelab, volume 1
[ESA-CR[P]-922-VOL-1] N77-26219
Study on the feasibility of structural thermal canister for the instrument pointing sub-system of the Spacelab, volume 2
[ESA-CR[P]-922-VOL-2] N77-26220
CAPACITORS
Principal considerations in large energy-storage capacitor banks
[LA-UR-76-2387] N77-26392
CAPACITY
Aircraft industry capacity study
[AD-A037837] N77-26071
CAPE HATTERAS [NC]
Classification of coastal environments
[AD-A036770] N77-26750
CAPTIVE TESTS
Project DAME: Tactical instrumented missile simulation testing
[AD-A035600] N77-26192
CARBON
Chemical modification of carbon electrodes
[AD-A036991] N77-26264
The phase composition of alloys of the system Cr-Si-C
[BLL-M-25504-[5828.4F]] N77-26268
CARBON DIOXIDE
Negative ions in CO2
[AD-A037149] N77-26262
CARBON DIOXIDE LASERS
Far infrared chemical lasers
[COO-2523-8] N77-26483
CARBON FIBER REINFORCED PLASTICS
The analysis of reinforced holes in carbon fibre plates
N77-26556
CARBON FIBERS
Thermal degradation studies of fibers and composite base materials
[AD-A037604] N77-26245
CASCADE FLOW
Analysis of an unsteady numerical scheme for calculation of transonic flow --- cascade flow
N77-26444

CASSEGRAIN ANTENNAS
The complete electromagnetic fields in the focal region of a paraboloidal reflector
[AD-A035052] N77-26364
CASTING
Machine casting of ferrous alloys
[AD-A035715] N77-26273
Casting titanium and zirconium in zircon sand molds
[PB-264253/6] N77-26292
CATALYSTS
XRF analysis of some regenerated catalysts
[MRL-TN-388] N77-26247
CATALYTIC ACTIVITY
Electrochemical theory of catalysis in metals
[UCRL-TRANS-11186] N77-26252
CATHODE RAY TUBES
An investigation of basic noise properties of field emission
[AD-A037094] N77-26390
Investigation of coupling of field emission cold cathode guns for gas lasers
[AD-A037734] N77-26510
Evaluation of the Burroughs 3500 CRT Enhancement Program communications system
[AD-A037086] N77-26820
Cathodoluminescence studies of the 1.4 eV bands in CdTe
[SAND-76-5472] N77-26995
CATHODES
Cathodoluminescence studies of the 1.4 eV bands in CdTe
[SAND-76-5472] N77-26995
CAVES
Seismic detection of subterranean cavities
[AD-A035711] N77-26744
CAVITIES
State-space solution of transient electromagnetic problems
[AD-A037087] N77-26377
Cavity detection by means of seismic shear and compressional wave refraction techniques
[TID-27225] N77-26733
CDC 6600 COMPUTER
How to use the CDC 6600 G-machine from a remote terminal
[UCID-30095] N77-26835
CEILINGS [METEOROLOGY]
Application of the AN/GVS-5 laser rangefinder to cloud base height measurements
[AD-A038013] N77-26503
CELLS [BIOLOGY]
Isolation of antibody forming cells by using cluster formation in combination with velocity sedimentation
[MBL-1976-6] N77-26790
CEMENTS
Precision of selected concrete test methods
[PB-263550/6] N77-26558
Environmental considerations of selected energy conserving manufacturing process options. Volume 10: Cement industry report
[PB-264276/7] N77-26687
CENTRAL PROCESSING UNITS
Communications processor system, volume 1, 2, and 3
[AD-A036873] N77-26370
Communications processor system, volume 8
[AD-A036874] N77-26371
Communications processor system
[AD-A037159] N77-26372
Communications processor system, volumes 4 and 5
[AD-A037158] N77-26373
CERAMICS
High temperature properties and processes in ceramics: Thermomigration
[COO-2923-001] N77-26314
Synthesis of new superhard materials and their application to cutting tools
[AD-A035579] N77-26316
CESIUM ENGINES
The ESTEC electric propulsion test facility
N77-26225
Recent results of tests of experimental cesium field emitters with the ESTEC electric propulsion test facility
N77-26233
CESIUM 137
Cesium-137 whole-body content in a normal New Mexico population
[LA-UR-76-2097] N77-26798
CHALCOGENIDES
Space processing of chalcogenide glass
[NASA-CR-150311] N77-26176
CHANDRASEKHAR EQUATION
Levinson- and Chandrasekhar-type equations for a general, discrete-time linear estimation problem
[AD-A037678] N77-26902
CHANNEL FLOW
Electro-chemical measurements of mass transfer in semi-cylindrical hollows with laminar flow in a channel --- artificial membrane lung oxygenator development
[OUEL-1175/76] N77-26441
CHANNELS [DATA TRANSMISSION]
An architectural approach to X25
N77-26856
MODSIM: Its application to telecommunications --- simulation of modulated communication channels
N77-26910
CHAPMAN-ENSKOG THEORY
An application of the Chapman-Korst theory to supersonic nozzle-afterbody flows
[AD-A035254] N77-26447
CHARGE COUPLED DEVICES
CCD integrated circuit for transient recorders
[UCRL-78360] N77-26398
Development study for a high accuracy star sensor. Volume 1: Study and development of an outline concept --- noting camera tubes and CCD
[ESA-CR[P]-923-VOL-1] N77-26945
Development study for a high accuracy star sensor. Volume 2: Detailed investigation of preferred concept --- noting CCD area imaging device
[ESA-CR[P]-923-VOL-2] N77-26946
CHARGED PARTICLES
Correlated electric field and low-energy electron measurements in the low-altitude polar cusp
[NASA-CR-152863] N77-26739
Magnetospheric magnetic field modeling
[AD-A037492] N77-26740
CHEMICAL ANALYSIS
Measurement techniques for inorganic trace materials in control system streams
[PB-264345/0] N77-26714
CHEMICAL ATTACK
Complex formation in metal dissolution and metal treatment
[AD-A037404] N77-26305
CHEMICAL ENGINEERING
Synthesis of indium phosphide
[AD-A035507] N77-27002
CHEMICAL LASERS
Far infrared chemical lasers
[COO-2523-8] N77-26483
Investigation of induced unimolecular decomposition for development of visible chemical lasers
[COO-2920-2] N77-26486
DF laser propagation analysis
[AD-A037813] N77-26501
CHEMICAL PROPERTIES
Chemical modification of carbon electrodes
[AD-A036991] N77-26264
CHEMICAL REACTIONS
Quenched flames with inhibitors: A theoretical analysis [theoretical analysis of quenched flames]
[BNL-21977] N77-26254
The coherent flame model for turbulent chemical reactions
[AD-A036768] N77-26261
A mass spectrometer investigation of the chemistry of plateau burning propellants
[AD-A035602] N77-26332
Monte Carlo analysis of uncertainty propagation in a stratospheric model. 2: Uncertainties due to reaction rates
[NASA-TM-X-71339] N77-26349
Energy and chemical change --- information theory approach to branching ratios
[AD-A035695] N77-26927
CHEMICAL WARFARE
Material studies for protective masks
[AD-A036736] N77-26310
CHINESE PEOPLES REPUBLIC
Meteorological service in aid of agricultural production
N77-26757
CHLORINE
Absolute rate constant for the reaction of atomic chlorine with hydrogen peroxide vapor over the temperature range 265-400 K
[NASA-TM-X-71340] N77-26248
Environmental considerations of selected energy conserving manufacturing process options. Volume 12: Chlor-alkali industry report
[PB-264278/3] N77-26689
CHLOROPHYLLS
Analysis of laser fluorosensor systems for remote algae detection and quantification
[NASA-TN-D-8447] N77-26480
CHROMATES
Polychromatic, flashlamp-pumped dye lasers
[AD-A037393] N77-26498
CHROMATOGRAPHY
The determination of the molecular weight distribution of polymers by permeation chromatography on porous glass. 1: Dextrans up to a molecular weight of 600000
[BLL-M-24884-[5828.4F]] N77-26246
CHROMIUM ALLOYS
The phase composition of alloys of the system Cr-Si-C
[BLL-M-25504-[5828.4F]] N77-26268
Development of all-position coated welding electrode of chromium-enriched cupronickel alloy
[AD-A037150] N77-26306
CHROMIUM STEELS
Creep, cyclic creep, and fatigue fracture in a low alloy steel --- creep crack propagation
N77-26289
CIRCUIT BOARDS
Optimizing path printed circuit board router --- for ILLIAC 4 computers
[UCRL-78564] N77-26408
CIRCUIT DIAGRAMS
CDSLG: An interactive program for the description of circuits
N77-26912
CIRCUIT RELIABILITY
Proceedings of the ECOM Hybrid Microcircuit Symposium, 1976
[AD-A035246] N77-26404
Forward reasoning and dependency-directed backtracking in a system for computer-aided circuit analysis
[AD-A035719] N77-26411
CIRCUITS
A technical description of the Automated Technical Control [ATEC] system AN/GYM-12-[V]
[AD-A037943] N77-26382
Factors affecting the open-circuit voltage and electrode kinetics of some iron/titanium redox flow cells
[NASA-TM-X-73669] N77-26612
CIRCULAR PLATES
Approximate method for strength analysis of circular axially symmetric plates of variable thickness, with ribs on one side and subject to an axially symmetric load
[BLL-RTS-10426] N77-26531
CIRCULATION
Lift, circulation and pressure distributions for a foil oscillating in pitching motion in a perfect fluid
[UFD-1] N77-26422
CITIES
Urban design and public exposure to carbon monoxide
[ANL-76-XX-22] N77-26707
CIVIL AVIATION
Analysis of flight equipment purchasing practices of representative air carriers
[NASA-CR-154619] N77-27021
CLASSICAL MECHANICS
Classical dynamics of triatomic system: Energized harmonic molecules
[CALT-767P4-49] N77-26929
CLASSIFIERS
The zig zag classifier: A windsifter with a novel classifying principle
[BLL-RTS-10357] N77-26420
CLIMATE
Reports from the German Meteorological Service. Volume 18, no. 141: The climate of Hamburg. Analysis for purposes of applied climatology with catalog of data --- period 1931-1970
[ISBN-3-88148-149-4] N77-26752
Meteorology and hydrology in aid of food production
N77-26755
Weather, climate and human settlements
[WMO-448] N77-27038
CLIMATOLOGY
Reports from the German Meteorological Service. Volume 18, no. 141: The climate of Hamburg. Analysis for purposes of applied climatology with catalog of data --- period 1931-1970
[ISBN-3-88148-149-4] N77-26752
CLINICAL MEDICINE
A cervix-to-rectum measuring device in a radiation applicator for use in the treatment of cervical cancer
[NASA-CASE-GSC-12081-2] N77-26796
CLOUD HEIGHT INDICATORS
Application of the AN/GVS-5 laser rangefinder to cloud base height measurements
[AD-A038013] N77-26503
Mesoscale determination of cloud-top height: Problems and solutions
[AD-A037954] N77-26776
CLOUD PHYSICS
Atmospheric Cloud Physics Laboratory [ACPL] optical motion control study
[AD-A037250] N77-26741
Atmospheric cloud physics thermal systems analysis
[NASA-CR-150312] N77-26753
CLOUD SEEDING
Project Skywater: Atmospheric water resources program
[PB-263952/4] N77-26785
CLOUDS [METEOROLOGY]
Simulation of cold cloud precipitation in a three-dimensional mesoscale model
[PB-265265] N77-26786
CLUMPS
Isolation of antibody forming cells by using cluster formation in combination with velocity sedimentation
[MBL-1976-6] N77-26790
CLUTTER
Cubic splines in clutter modeling
[AD-A036975] N77-26883
COAL
Analysis and testing of JP-5 fuel derived from coal
[AD-A036073] N77-26333
CDIF combustor design
[TID-27143] N77-26393

Modeling two-phase flow in a swirl combustor
[COO-4062-2] N77-26432
Internalizing social costs in power plant siting: Some examples for coal and nuclear plants in the United States
[CONF-761103-16] N77-26816

COAL GASIFICATION
Energy Conversion Alternatives Study [ECAS], phase 2. Volume 1: Executive summary
[NASA-CR-134949-VOL-1] N77-26631
Energy Conservation Alternatives Study [ECAS], phase 2: Volume 2: Advanced energy conversion systems, - conceptual designs. Part 1: Analytical approach
[NASA-CR-134949-VOL-2-PT-1] N77-26632
Energy Conversion Alternatives Study [ECAS], phase 2. Volume 2: Advanced energy conversion systems - conceptual designs. Part 2: Closed turbine cycles
[NASA-CR-134949-VOL-2-PT-2] N77-26633
Energy Conversion Alternatives Study [ECAS], phase 2. Volume 2: Advanced energy conversion systems - conceptual designs. Part 3: Open cycle gas turbines and open cycle MHD
[NASA-CR-134949-VOL-2-PT-3] N77-26634
Energy Conversion Alternatives Study [ECAS], phase 2. Volume 2: Advanced energy conversion systems: Conceptual designs. Part 4: Summary of results
[NASA-CR-134949-VOL-2-PT-4] N77-26635
Energy Conversion Alternatives Study [ECAS], phase 2. Volume 3: Research and development plans and implementation assessment
[NASA-CR-134949-VOL-3] N77-26636
Energy Conversion Alternatives Study [ECAS], phase 2. Integrated coal gasifier/molten carbonate fuel cell powerplant conceptual design and implementation assessment
[NASA-CR-134955] N77-26637

COASTAL PLAINS
Classification of coastal environments
[AD-A036770] N77-26750

COASTAL WATER
The use of remote sensing in solving Florida's geological and coastal engineering problems
[NASA-CR-153286] N77-26584

COASTS
Development and application of operational techniques for the inventory and monitoring of resources and uses for the Texas coastal zone
[E77-10174] N77-26576

COATINGS
Application of sputter-deposited lamellar composite technology to the development of high temperature turbine blade materials and airfoil fabrication
[AD-A037349] N77-26151
Electroinitiated polymerization of monomers on metal electrodes
[AD-A036989] N77-26321

COAXIAL CABLES
The effects of periodic cable defects upon the transmission of wideband signals
[BLL-TRANS-3433-[9022.81]] N77-26344

COBALT
Spectrophotometric determination of boron in cobalt and nickel coatings by use of carminic acid
[AD-A037344] N77-26293

CODING
A computer code for thrustor ion optics N77-26228
Computed ion trajectories in thrustor beams N77-26229
Digital encoding for secure data communications
[AD-A035848] N77-26369
Two-dimensional delta-mod facsimile coding
[UCRL-77999] N77-26840
KOVEC user's manual --- coding elastic and plastic properties
[UCID-17306] N77-27018

COEFFICIENTS
An extended set of cosmic ray variational coefficients for European cosmic ray stations
[AD-A036992] N77-27062

COHESION
Research on crystal chemistry studies --- scattering of light by magnetic spheres
[AD-A035478] N77-27001

COLD CATHODES
Investigation of coupling of field emission cold cathode guns for gas lasers
[AD-A037734] N77-26510

COLD WEATHER TESTS
Low-temperature handwear with improved dexterity
[AD-A037535] N77-26811

COLLIMATORS
Some basic considerations of measurements involving collimated direct sunlight
[NASA-CP-2010] N77-26622

COLLOCATION
Least-squares collocation as a gravitational inverse problem
[AD-A037008] N77-26749

COLOR CENTERS
Lattice defects in ionic crystals: Report on the Berlin conference [1976]
[AD-A037950] N77-27016

COLOR PHOTOGRAPHY
Saturation, heu, and normalized color: Calculation, digitization effects, and use
[AD-A037772] N77-26472

COMBINATORIAL ANALYSIS
Applications of pattern theory to problems in computer science
[AD-A037128] N77-26875

COMBUSTION
Investigation of the relationship between quasi-global and detailed kinetics mechanisms for the combustion of methane
[UCRL-78424] N77-26255

COMBUSTION CHAMBERS
Pulsating combustion device miniaturization
[AD-A035707] N77-26147
Advanced thrust chamber technology
[NASA-CR-135221] N77-26221
CDIF combustor design
[TID-27143] N77-26393
Modeling two-phase flow in a swirl combustor
[COO-4062-2] N77-26432

COMBUSTION PRODUCTS
Prediction of test cell visible emissions
[AD-A037694] N77-26146
Urban design and public exposure to carbon monoxide
[ANL-76-XX-22] N77-26707
Measurement techniques for inorganic trace materials in control system streams
[PB-264345/0] N77-26714
National assessment of the urban particulate problem. Volume 1: Summary of national assessment
[PB-263665/2] N77-26715

COMBUSTION STABILITY
Space shuttle response to acoustic combustion instability in the solid rocket boosters
[AD-A037157] N77-26200

COMMAND AND CONTROL
Command Center Information System [CCIS] functions and capabilities
[AD-A037146] N77-26872

COMMERCIAL AIRCRAFT
Judgements of relative noisiness of a supersonic transport and several commercial-service aircraft
[NASA-TN-D-8434] N77-26702

COMMUNICATION CABLES
Antennas and central HF cabling --- radio interferometer for satellite orbit determination N77-26209

COMMUNICATION EQUIPMENT
Communications station evaluation report, Selfridge ANGB, Michigan, 9-18 November 1976
[AD-A037479] N77-26120
Communications processor system, volumes 4 and 5
[AD-A037158] N77-26373

COMMUNICATION SATELLITES
Analysis of the ARPA satellite circuit between Etam, W. Va., and Goonhilly, UK and proposed improvements to the circuit design
[AD-A037675] N77-26194
High altitude satellite communications, with cross-links
[AD-A037118] N77-26195
Local, regional and large scale integrated networks. Volume 3. Recent advances in large scale integrated networks
[AD-A035951] N77-26352
Local, regional and large scale
[AD-A03593] N77-26354
Development of a klystron for satellite operation in the 12 GHz frequency band
[BMFT-FB-W-76-24] N77-26358

COMMUNICATIONS TECHNOLOGY SATELLITE
On-orbit performance of the 12 GHz, 200 watt transmitter experiment package for CTS
[NASA-TM-X-73636] N77-26183
A depolarization and attenuation experiment using the CTS satellite --- meteorological radar
[NASA-CR-152535] N77-26347

COMMUNITIES
Weather, climate and human settlements
[WMO-448] N77-27038

COMPATIBILITY
Zirconia-foil compatibility test. Phase I
[TE-4219-28-77] N77-26645

COMPENSATORY TRACKING
The development, maintenance, and mathematical description of tracking behavior in man and the rhesus monkey
[AD-A038006] N77-26802
Effects of direct side force control on pilot tracking performance
[AD-A036083] N77-26812

COMPILERS
Optimization guide for programs compiled under IBM FORTRAN H [OPT=2]
[NASA-TM-X-71307] N77-26827
SIMULA: A high-level general-purpose discrete events simulation N77-26909

COMPOSITE MATERIALS
Optimum design of composite wing structures with twist constraint for aeroelastic tailoring
[AD-A038029] N77-26099
Application of sputter-deposited lamellar composite technology to the development of high temperature turbine blade materials and airfoil fabrication
[AD-A037349] N77-26151
Biaxial fatigue loading of notched composites
[NASA-CR-145198] N77-26241
Techniques for flaw detection in composite material structures
[AD-A036026] N77-26243
Thermal degradation studies of fibers and composite base materials
[AD-A037604] N77-26245
Proceedings of the TTCP-3 critical review: Techniques for the Characterization of Polymeric Materials
[AD-A036082] N77-26319
Damage tolerance of thin skin sandwich panels
[AD-A037526] N77-26559

COMPOSITE STRUCTURES
Composite sandwich lattice structure
[NASA-CASE-LAR-11898-2] N77-26242
Water diffusion membranes 3 [pervaporation and heat rejection through composite membranes]
[NASA-CR-151967] N77-26423
Nonlinear analysis of bonded joints with thermal effects
[NASA-CR-153263] N77-26534
Stability of flat, clamped, rectangular sandwich panels subjected to combined inplane loadings
[AD-A037489] N77-26564

COMPOSITION [PROPERTY]
Literature survey on toxicologic implications of manipulating some solid rocket propellants
[MBL-1976-12] N77-26326

COMPRESSIBLE FLOW
Variational energy principle for compressible, baroclinic flow. 2: Free-energy form of Hamilton's principle
[NASA-TM-X-71343] N77-26425

COMPRESSION WAVES
Cavity detection by means of seismic shear and compressional wave refraction techniques
[TID-27225] N77-26733

COMPRESSIVE STRENGTH
Precision of selected concrete test methods
[PB-263550/6] N77-26558

COMPUTATION
Computional techniques for the reduction of nonlinear effects using passive compensating networks
[AD-A035855] N77-26406
The influence of boundary point procedures on accuracy and efficiency in flow field calculations
[DOC-77SDR016] N77-26424
Comparison of calculated and measured maximum aboveground air pollutant concentrations and their respective distances from the source of release of large power plants
[ORNL-TR-4231] N77-26712
Overview of a linguistic theory of design
[AD-A036915] N77-26848
Overview of a linguistic theory of design
[AD-A036977] N77-26876
The computation and graphical display of the NSF Water Quality Index from the STORET data base using the integrated plotting package. Program documentation and users guide
[PB-264670/1] N77-27043

COMPUTER ASSISTED INSTRUCTION
Microcomputer controlled, interactive testing terminal development
[AD-A035731] N77-26821

COMPUTER GRAPHICS
Microcomputer controlled, interactive testing terminal development
[AD-A035731] N77-26821
GRAPHELP user's manual: Version 2 --- FORTRAN
[AD-A037564] N77-26826
WAND demonstration
[AD-A037199] N77-26832
The computation and graphical display of the NSF Water Quality Index from the STORET data base using the integrated plotting package. Program documentation and users guide
[PB-264670/1] N77-27043

COMPUTER INFORMATION SECURITY
RATS operating system
[UCRL-77378] N77-26819
Distributed capability computing system
[UCRL-77800] N77-26869

COMPUTER NETWORKS
WAND user's guide. Addendum
[AD-A037335] N77-26831

WAND demonstration
[AD-A037199] N77-26832
Second European Users' Workshop on Network Protocols
[NPL-COM-84] N77-26854
Present status of computer networks: An overview
N77-26855
Towards a unified view of high level protocols
N77-26857
Terminal access protocols on EURONET
N77-26858
Proposal for a scroll mode virtual terminal in European informatics network
[EIN/CCG/76/008] N77-26859
User's guide to the Octopus computer network [the SHOC manual]
[UCID-30048-REV-3] N77-26868
Distributed capability computing system
[UCRL-77800] N77-26869

COMPUTER PROGRAMMING
Software system of the interferometer computer
N77-26213
Computerized determination of the satellite direction --- for orbit determination using radio interferometer
N77-26214
Comparison between possible variants of a program using an unsteady numerical scheme for calculation of the flow in a one-dimensional nozzle
N77-26443
Optimization guide for programs compiled under IBM FORTRAN H [OPT=2]
[NASA-TM-X-71307] N77-26827
NASA software specification and evaluation system: Software verification/validation techniques
[NASA-CR-150299] N77-26828
Abstraction and verification in Alphard: Introduction to language and methodology
[AD-A035487] N77-26833
CNESRO, CNSIM-CNSTAT programs for the study of the maintenance and availability of a space system. Volume 1: Problem analysis and program realisation --- simulation and statistics programs for synchronous satellite system
[ESA-TM-174-VOL-1] N77-26841
CNESRO, CNSIM-CNSTAT programs for the study of the maintenance and availability of a space system. Volume 2: User's guide --- simulation and statistics programs for synchronous satellite systems
[ESA-TM-174-VOL-2] N77-26842
Everyman's guide to TIMES
[AD-A035733] N77-26850
Alerters on network databases
[AD-A037438] N77-26860
Alerting in database systems: Concepts and techniques
[AD-A037437] N77-26861
Strategies for the minimization of an unconstrained nonconvex function
[AD-A037820] N77-26890
KOVEC user's manual --- coding elastic and plastic properties
[UCID-17306] N77-27018

COMPUTER PROGRAMS
Computer programs for tethered-balloon system design and performance evaluation
[AD-A035505] N77-26085
Avionics evaluation program: Multiple aircraft, multiple sorties and cost accumulation
[AD-A037195] N77-26133
A computer program for the design of plane and axisymmetric supersonic wind tunnel nozzles
[ESA-TT-367] N77-26170
Skylab S191, S192 program descriptions --- earth radiation data analysis
[NASA-CR-152508] N77-26177
High altitude satellite communications, with cross-links
[AD-A037118] N77-26195
A computer program for the prediction of radiation from rocket exhaust plumes, volume 1
[AD-A037385] N77-26239
Speech understanding systems. Volume 1: Introduction and overview
[AD-A035165] N77-26359
Speech understanding systems. Volume 2: Acoustic front end
[AD-A035166] N77-26360
Speech understanding systems. Volume 5: Trip
[AD-A035278] N77-26363
Antenna select computer program [ANTSEL]
[AD-A036737] N77-26381
Computer-aided analysis of electronic filters
[ESA-TM-171] N77-26399
Forward reasoning and dependency-directed backtracking in a system for computer-aided circuit analysis
[AD-A035719] N77-26411
Nonlinear analysis of bonded joints with thermal effects
[NASA-CR-153263] N77-26534
University of Utah direct contact Geothermal Power Project report. A computer program for determining the thermodynamic properties of water
[UTEC-ME-76-171] N77-26642
Computer programs for seismology: Special applications to the high-gain long-period seismic network
[AD-A037963] N77-26751
Program documentation for the T4 EUO Crew Station simulation programs
[AD-A037944] N77-26808
GRAPHELP user's manual: Version 2 --- FORTRAN
[AD-A037564] N77-26826
WAND user's guide. Addendum
[AD-A037335] N77-26831
TRIX AC: A set of general purpose text editing commands
[UCID-30040[ED.8]] N77-26836
Candidate languages evaluation report --- Defense Department requirements
[AD-A037639] N77-26844
Verification and feasibility study of a micro-computer based ballistics algorithm
[AD-A036062] N77-26846
Quantitative methods for software reliability measurements
[AD-A035585] N77-26849
IMAG-3: Non-linear circuit analysis --- program for electronic circuit simulation at component level
N77-26906
ESAMEC: Computer-aided analysis of microwave electronic circuits in the frequency domain
N77-26907
ESTEL: A computer program for simulation of logic circuits
N77-26908
Program for trajectory calculation of pendulating projectiles
[ISL-R-104/76] N77-26917
Computer programs for the evaluation of activity and osmotic coefficients
[PB-262600/0] N77-27019
Computer Output Microforms Program And Concept Study [COMPACS] report
[AD-A035992] N77-27029
A computerized traffic control algorithm to determine optimal traffic signal settings
[NASA-TM-X-73607] N77-27035
Urban traffic control system traffic adaptive network signal timing program. Volume 1: Overview description; narrative description and flow charts of TANSTP routines
[PB-264054/8] N77-27040
Urban traffic control system traffic adaptive network signal timing program. Volume 2: Data base interface and support subroutines: Modified first generation routines
[PB-264055/5] N77-27041

COMPUTER STORAGE DEVICES
A four digit memory-mapped display
[NASA-CR-153265] N77-26112
RATS operating system
[UCRL-77378] N77-26819
A computer storage and retrieval system for scientific data
[AD-A037738] N77-27031

COMPUTER SYSTEMS DESIGN
Methodology and planning for a microprocessor-oriented real time controller design automation system
[UCID-17318] N77-26814

COMPUTER SYSTEMS PROGRAMS
Space surveillance software support. Volume 1, part 1, book 3: Computer program documentation
[AD-A033658] N77-26217
STARPAHC operational report
[NASA-CR-151432] N77-26794
Preliminary documentation of GEARBI: Solution of ODE systems with block-iterative treatment of the Jacobian
[UCID-30149] N77-26839
Candidate language evaluation and recommendation report --- Defense Department requirements
[AD-A037638] N77-26845
User's guide to the Octopus computer network [the SHOC manual]
[UCID-30048-REV-3] N77-26868
Controlling transactions between distributed computer resources
[UCRL-78282-REV-1] N77-26870

COMPUTER TECHNIQUES
Computional techniques for the reduction of nonlinear effects using passive compensating networks
[AD-A035855] N77-26406
Saturation, heu, and normalized color: Calculation, digitization effects, and use
[AD-A037772] N77-26472
Remote manipulator system steering capability for SVDS
[NASA-CR-151438] N77-26804
Command Center Information System [CCIS] functions and capabilities
[AD-A037146] N77-26872
An assessment of reliability of dialogue annotation instructions
[AD-A037109] N77-26874
Image processing research --- processing and reducing visual and two dimensional data
[AD-A035315] N77-26947

COMPUTERIZED DESIGN
Multiplex simulator design study
[AD-A037226] N77-26853

COMPUTERIZED SIMULATION
SPAERS: Simulation for the Performance Aircraft Engine Repair Systems
[AD-A035737] N77-26073
Design of turbofan engine controls using output feedback regulator theory
[NASA-TM-X-73622] N77-26136
Stability and thermal effects of field ion emitters
N77-26230
Field emission study
N77-26231
Comparison between two gas dynamic computation models of interior ballistics
[ISL-CO-219/76] N77-26328
Hardware simulation of KU-band spacecraft receiver and bit synchronizer, phase 2, volume 1 --- for space shuttle
[NASA-CR-151439] N77-26348
The complete electromagnetic fields in the focal region of a paraboloidal reflector
[AD-A035052] N77-26364
Program documentation for the T4 EUO Crew Station simulation programs
[AD-A037944] N77-26808
Personal flotation devices research, phase 1
[AD-A037221] N77-26810
Simulation of the performance of a collection of storage space allocation algorithms
[UCID-17251] N77-26834
CNESRO, CNSIM-CNSTAT programs for the study of the maintenance and availability of a space system. Volume 1: Problem analysis and program realisation --- simulation and statistics programs for synchronous satellite system
[ESA-TM-174-VOL-1] N77-26841
CNESRO, CNSIM-CNSTAT programs for the study of the maintenance and availability of a space system. Volume 2: User's guide --- simulation and statistics programs for synchronous satellite systems
[ESA-TM-174-VOL-2] N77-26842
Extended system modelling program - ESMP. Simulation of a large analogue computer on a PDP 11
[OUEL-1178/76] N77-26843
Computer-aided analysis of circuits and systems --- workshop held 24 Jan. 1977
[ESA-SP-123] N77-26904
Overall view of computer-aided analysis at ESTEC
N77-26905
ESTEL: A computer program for simulation of logic circuits
N77-26908
SIMULA: A high-level general-purpose discrete events simulation
N77-26909
MODSIM: Its application to telecommunications --- simulation of modulated communication channels
N77-26910
FTANAL: Computer-aided analysis of continuous and sampled linear control systems --- based on transfer functions
N77-26911
CDSLG: An interactive program for the description of circuits
N77-26912

COMPUTERS
User's guide for the STAR-100
[UCID-30133] N77-26837

CONCENTRATION [COMPOSITION]
Improvements to single-source model. Volume 1: Time-concentration relationships
[PB-264686/7] N77-26720

CONCORDE AIRCRAFT
Oversight hearings on the SST
[GPO-76-492] N77-26107

CONCRETES
Air blast effects on concrete walls
[ANL-CT-76-50] N77-26540
Precision of selected concrete test methods
[PB-263550/6] N77-26558
Reliability study of SINGER. Volume 1: Validation of model
[AD-A037819] N77-26561

CONDITIONING [LEARNING]
The development, maintenance, and mathematical description of tracking behavior in man and the rhesus monkey
[AD-A038006] N77-26802

CONDUCTIVE HEAT TRANSFER
Applying the reciprocity principle to solving heat conductivity problems
[AD-A037450] N77-26427
Application of the equivalency principle to the solution of heat conductivity problems
[AD-A037584] N77-26428

CONFERENCES
AGARD highlights 77/1 --- research and development economics, policies, and the space transportation system
N77-26074
Task-Oriented Flight Control Systems
[AGARD-LS-89] N77-26161

The DFVLR radio interferometer --- satellite orbit determination
[BMFT-FB-W-76-25] N77-26201
Field emission day --- conference proceedings, ESTEC, Noordwijk, Apr. 1976
[ESA-SP-119] N77-26223
NSF/RANN 4th Grantees' Conference on Production Research and Technology
[PB-265817/7] N77-26341
Proceedings of the ECOM Hybrid Microcircuit Symposium, 1976
[AD-A035246] N77-26404
International Conference on Hydrogen and its Prospects
[AD-A036936] N77-26696
International Conference on Photochemical Oxidant Pollution and Its Control. Proceedings, volume 1
[PB-264232/0] N77-26717
International Conference on Photochemical Oxidant Pollution and Its Control. Proceedings, volume 2
[PB-264233/8] N77-26718
Scientific lectures on meteorology --- conference proceedings, Geneva, May 1975
[WMO-435] N77-26754
Proceedings of a workshop on environmental oceanography of the Gulf of Mexico
[ORO-5017-1] N77-26787
Second European Users' Workshop on Network Protocols
[NPL-COM-84] N77-26854
Report of the 1976 Joint Workshop on Pattern Recognition and Artificial Intelligence
[AD-A037503] N77-26878
Transactions of the 22nd Conference of Army Mathematicians
[AD-A037211] N77-26886
Computer-aided analysis of circuits and systems --- workshop held 24 Jan. 1977
[ESA-SP-123] N77-26904
International Conference on Radiation Effects in Semiconductors
[AD-A036994] N77-26936
Current heating of plasma in the L-2 stellarator
[CONF-761012-29] N77-26979
Symposium on the structure of non-crystalline materials
[AD-A037948] N77-27012
Experiment in information sharing: The LLL-Atlanta University Workshops
[UCID-17340] N77-27026

CONFINEMENT
Theory and calculations on non-magnetic confinement of a dense plasma
[BLL-CTO-1291-[9091.9F]] N77-26962

CONGRESSIONAL REPORTS
Oversight hearings on the SST
[GPO-76-492] N77-26107

CONSERVATION
Environmental considerations of selected energy conserving manufacturing process options. Volume 11: Glass industry
[PB-264277/5] N77-26688

CONSTRAINTS
The influence of support characteristics on the stability of an elastic system subjected to a circulatory force
[AD-A037929] N77-26918

CONSTRUCTION
Construction details of the interferometer rotary drive
N77-26205

CONSTRUCTION MATERIALS
Development of directionally solidified eutectic nickel alloys for use in aircraft gas turbines at metal temperatures exceeding 1000 C
[AD-A037246] N77-26150
Optimization of the characteristics of structural reinforced plastics. Part I: General theory
[CRIF-PL-10] N77-26315
Impurity control in near-term Tokamak reactors
[CONF-760935-48] N77-26984

CONTAINERLESS MELTS
Design, construction, test and field support of a containerless payload package for rocket flight --- electromagnetic heating and confinement
[NASA-CR-149997] N77-26184

CONTAMINANTS
Robustness of linear estimators to misspecification of trend
[COO-2874-4] N77-26709
Interpolation of air pollution: A stochastic approach
[COO-2874-11] N77-26710
Comparison of calculated and measured maximum aboveground air pollutant concentrations and their respective distances from the source of release of large power plants
[ORNL-TR-4231] N77-26712

CONTAMINATION
Measuring the radioactivity of drinking water with the liquid counters M2H in combination with contamination meters IM 4457
[MBL-1976-10] N77-26934

CONTINENTAL SHELVES
Application of LANDSAT-2 to the management of Delaware's marine and wetland resources
[E77-10173] N77-26575
A social and economic impact study of offshore petroleum and natural gas development in Alaska, phase 2
[PB-264706/3] N77-26693

CONTINENTS
Theoretical study of the evolution of mixed phase cumulus clouds
[BNWL-SA-5880] N77-26766

CONTRAST
Experimental determination of the contrast of two interfering argon laser beams --- laser anemometer development
[ISL-R-116/76] N77-26490

CONTROL SURFACES
Unsteady two-dimensional wing flow at large control surface angles
[MBB-UFE-1183[O]] N77-26089

CONTROL THEORY
Integral functionals, normal integrands and measurable selections
[AD-A037561] N77-26882

CONTROL UNITS [COMPUTERS]
Controlling transactions between distributed computer resources
[UCRL-78282-REV-1] N77-26870

CONTROLLED FUSION
The controlled thermonuclear fusion research programme in the USSR for 1976 - 1977
[BLL-CTO-1296-[9091.9F]] N77-26969

CONVECTION
Numerical simulation of natural convection in closed containers using a fully implicit method
[DP-MS-75-127] N77-26431

CONVECTIVE HEAT TRANSFER
Gasification and ignition of a condensed fuel by a hot stagnant gas
[AD-A037976] N77-26334

CONVERSATION
Environmental considerations of selected energy conserving manufacturing process options. Volume 13: Phosphoric acid industry report
[PB-264279/1] N77-26690

COOLING
Stability and transition in boundary layers on reentry vehicle nosetips
[AD-A035712] N77-26449
Solar heating and cooling technical data and systems analysis
[NASA-CR-150305] N77-26611

COPOLYMERS
Properties and structure of polymeric alloys
[AD-A037240] N77-26318

COPPER
Environmental considerations of selected energy conserving manufacturing process options. Volume 14: Primary copper industry report
[PB-264280/9] N77-26691

COPPER ALLOYS
Development of all-position coated welding electrode of chromium-enriched cupronickel alloy
[AD-A037150] N77-26306
Analysis of the friction behavior at high sliding velocities and pressure for gilding metal, annealed iron, copper and projectile steel
[AD-A035674] N77-26521

CORN
Systems study of fuels from sugarcane, sweet sorghum, sugar beets, and corn
[TID-27336] N77-26324

CORRECTION
Evaluation of a correction method for digital computer lag in hybrid systems
[SAND-76-0343] N77-26867

CORRELATION
Robustness of linear estimators to misspecification of trend
[COO-2874-4] N77-26709

CORROSION PREVENTION
Intergranular stress corrosion cracking of sensitized chrome-nickel steels in boiling water
[ORNL-TR-4272] N77-26287
Fundamental investigation of fatigue crack growth retardation in aluminum alloys
[AD-A037184] N77-26295
Study of corrosion and its control in aluminum solar collectors
[COO-2934-76-1] N77-26673

CORROSION RESISTANCE
Inhibition of hydrogen embrittlement in high strength steel
[AD-A037355] N77-26304

CORROSION TESTS
Study of corrosion and its control in aluminum solar collectors
[COO-2934-76-1] N77-26673

COSMIC RAYS
An extended set of cosmic ray variational coefficients for European cosmic ray stations
[AD-A036992] N77-27062

COST ANALYSIS
Application of the ice-maker heat pump to an annual cycle energy system
[CONF-761107-13] N77-26659
Comparative cost study of the processes for producing niobium-tin [Nb3 Sn] superconducting tapes for their application to power transmission lines
[ERDA-76-160] N77-26999

COST ESTIMATES
Parametric study of transport aircraft systems cost and weight
[NASA-CR-151970] N77-26106

COUNTERS
Measuring the radioactivity of drinking water with the liquid counters M2H in combination with contamination meters IM 4457
[MBL-1976-10] N77-26934

COUPLED MODES
Finite element stability analysis for coupled rotor and support systems
[NASA-CR-152024] N77-26079

COUPLING
Investigation of coupling of field emission cold cathode guns for gas lasers
[AD-A037734] N77-26510

COUPLING COEFFICIENTS
The singularity expansion representation of the transient electromagnetic coupling through a rectangular aperture
[AD-A036999] N77-26374
The singularity expansion representation of the transient electromagnetic coupling through a rectangular aperture
[AD-A037353] N77-26375

COVARIANCE
Covariance analysis of some nonstationary time series
[AD-A037482] N77-26901

CRACK PROPAGATION
Flaw growth of 7075, 7475, 7050 and 7049 aluminum alloy plate in stress corrosion environments
[NASA-CR-150313] N77-26272
Creep, cyclic creep, and fatigue fracture in a low alloy steel --- creep crack propagation
N77-26289
Fundamental investigation of fatigue crack growth retardation in aluminum alloys
[AD-A037184] N77-26295
A comparison of the effects of specimen thickness and subcritical crack growth on several nonlinear fracture toughness parameters
[AD-A037470] N77-26296
The role of solvated electrons in stress corrosion cracking phenomena. Part 1: Conceptual considerations
[AD-A037527] N77-26297
Effects of microstructure on fatigue crack growth of high-strength aluminum alloys
[AD-A037156] N77-26300
Materials and mechanics of rate effects in brittle fracture
[COO-2422-08] N77-26541

CRACKING [FRACTURING]
Nondestructive evaluation of metal fatigue
[AD-A037672] N77-26299
Localized damage in a viscous medium glass. Appendix A. Variations in localized impact damage caused by nominally similar impacts. Appendix B. Crack branching at Hertz cracks
[AD-A037303] N77-26311

CRASH INJURIES
Development of smoke abated aircraft crash/rescue fire fighting trainer
[AD-A035999] N77-26260

CREEP PROPERTIES
Creep, cyclic creep, and fatigue fracture in a low alloy steel --- creep crack propagation
N77-26289
Materials applications and mathematical properties of the rational polynomial creep equation
[ORNL-5202] N77-26545
Development of simplified analysis methods for ratchetting and creep fatigue
[CONF-761107-6] N77-26546
Impurity effects on the creep of polycrystalline magnesium and aluminum oxides at elevated temperatures
[COO-1591-31] N77-26996

CROP GROWTH
Estimated winter wheat yield from crop growth predicted by LANDSAT
[NASA-CR-151431] N77-26580
Measurement of growth, measurement and bidirectoral scattering parameters of wheat
[NASA-CR-151351] N77-26592

CROP IDENTIFICATION
LACIE: A look to the future
[NASA-TM-74623] N77-26589

CRUDE OIL
XRF analysis of some regenerated catalysts
[MRL-TN-388] N77-26247
A social and economic impact study of offshore petroleum and natural gas development in Alaska, phase 1
[PB-264705/5] N77-26677

Environmental considerations of selected energy conserving manufacturing process options. Volume 4: Petroleum refining industry report
[PB-264270/0] N77-26681
A social and economic impact study of offshore petroleum and natural gas development in Alaska, phase 2
[PB-264706/3] N77-26693

CRYOGENICS
Observations on European low-temperature physics research: An annotated directory of low-temperature physics in British universities and some comments on the low temperature physics programs in Europe
[AD-A036959] N77-26339
Cryogenic instrumentation --- superconducting devices and materials
[AD-A037133] N77-26476

CRYSTAL DEFECTS
Electron microscope study of defects in annealed boron implanted silicon
[AD-A037956] N77-27006
Investigation of defects and impurities in silicon-on-sapphire
[AD-A037753] N77-27011
Lattice defects in ionic crystals: Report on the Berlin conference [1976]
[AD-A037950] N77-27016

CRYSTAL DISLOCATIONS
Point defect interactions and growth of dislocation loops
[CONF-761027-7] N77-27000

CRYSTAL GROWTH
High pressure furnace growth of mercury cadmium telluride
[AD-A036918] N77-26294
Growth of pure single crystals of alkali halides and alkaline earth fluoride
[AD-A037795] N77-27014
Evaluation of sulfosalts
[AD-A037946] N77-27015

CRYSTAL OPTICS
Crystal violet as a mode-locker of the rhodamine 6G dye laser
[AD-A037643] N77-26499

CRYSTAL OSCILLATORS
High stability temperature compensated crystal oscillator study
[AD-A036908] N77-26415

CRYSTAL STRUCTURE
The structure of a mixed-valence iron fluoride, Fe2F5.2H2O
[AD-A035714] N77-26266
Application of robust/resistant techniques to crystal structure refinement
[BNWL-SA-5936] N77-26991
Piezoelectricity and pyroelectricity in crystalline polymers
[AD-A037606] N77-27004
The electronic structure of crystalline solids: Their surfaces and interfaces
[AD-A037797] N77-27008

CRYSTALS
The application of a curved graphite crystal monochromator to X-ray diffractometry
[AD-A037952] N77-26474
Optical properties of layer compounds Ga s sub x Se sub 1-x
[LBL-5464] N77-26994

CUBIC EQUATIONS
Cubic splines in clutter modeling
[AD-A036975] N77-26883

CUMULUS CLOUDS
Theoretical study of the evolution of mixed phase cumulus clouds
[BNWL-SA-5880] N77-26766

CYBERNETICS
Cybernetics: An overview
[AD-A037993] N77-26877

CYCLES
Magnetic stirling cycles: A new application for magnetic materials
[NASA-TM-X-73676] N77-26616

CYCLIC HYDROCARBONS
Electroinitiated polymerization of monomers on metal electrodes
[AD-A036989] N77-26321

CYLINDRICAL BODIES
Stresses produced in a long cylinder by a nuclear thermal environment
[AD-A037426] N77-26539
Aeolian tones from circular cylinders of non-uniform cross section
[AD-A035994] N77-26923

CYLINDRICAL SHELLS
Analysis of a cylindrical shell vibrating in a cylindrical fluid region
[ANL-76-48] N77-26544
Development of simplified analysis methods for ratchetting and creep fatigue
[CONF-761107-6] N77-26546
Static and dynamic behavior of noncircular cylindrical shells
[AD-A037673] N77-26562

CYSTEAMINE
In vitro evaluation of some latent radioprotective compounds --- cysteamine derivatives
[MBL-1976-11] N77-26792

D

DACRON [TRADEMARK]
Determination of the airworthiness of ZPG-3W cotton D621 and the ZPG-2 dacron GDC-5 airship envelopes
[AD-A037548] N77-26096

DATA ACQUISITION
Calculator controlled strain gage data acquisition system
[SAND-76-0146] N77-26467
Analytical and experimental assessment of highway impact on air quality
[PB-264590/1] N77-26724
Computer-based transportable data acquisition and control system
[UCRL-78339] N77-26813
Study, tests, and evaluation for wideband high-density data acquisition [WHIDDA]
[AD-A037410] N77-26822

DATA BASES
Geographic data base development
[AD-A037116] N77-26823
WAND user's guide
[AD-A037436] N77-26830
WAND demonstration
[AD-A037199] N77-26832
Alerting in database systems: Concepts and techniques
[AD-A037437] N77-26861
An alerting system for a database management system
[AD-A037201] N77-26862
Controlling transactions between distributed computer resources
[UCRL-78282-REV-1] N77-26870
Transportation-related data bases extracted from the national index of energy and environmental data bases. Part 1: Digest of detailed data base descriptions
[UCID-17316-PT-1] N77-27036
Transportation-related data bases extracted from the national index of energy and environmental data bases. Part 2: Detailed data base descriptions
[UCID-17316-PT-2] N77-27037
The computation and graphical display of the NSF Water Quality Index from the STORET data base using the integrated plotting package. Program documentation and users guide
[PB-264670/1] N77-27043

DATA COLLECTION PLATFORMS
Manual for adjustment and handling of platforms for data collection via satellite [CDCP]
[NASA-TM-75020] N77-26182

DATA LINKS
High altitude satellite communications, with cross-links
[AD-A037118] N77-26195
Advanced monitoring techniques for digital communication systems
[AD-A037082] N77-26380
An architectural approach to X25
N77-26856
Low-cost optical data link design study
[AD-A035294] N77-26948

DATA MANAGEMENT
Computer-based transportable data acquisition and control system
[UCRL-78339] N77-26813
WAND user's guide
[AD-A037436] N77-26830
WAND user's guide. Addendum
[AD-A037335] N77-26831
Abstraction and verification in Alphard: Introduction to language and methodology
[AD-A035487] N77-26833
An alerting system for a database management system
[AD-A037201] N77-26862

DATA PROCESSING
Manual for adjustment and handling of platforms for data collection via satellite [CDCP]
[NASA-TM-75020] N77-26182
Towards a global operational system of meteorological satellites
N77-26759
Feasibility study of networks
[COO-2487-4] N77-26864
Network pattern processors
[AD-A037129] N77-26871
Automatic pattern recognition in a multi-sensor environment
[AD-A037968] N77-26880
Experimental development of a FLIR sensor processor
[AD-A037143] N77-26951
Experimental development of a FLIR sensor processor
[AD-A037142] N77-26952

DATA PROCESSING TERMINALS
Monitor of distributed data systems [MODDS]. Part 1: Digest of functional specifications
[UCID-17314-PT-1] N77-26818
Terminal access protocols on EURONET
N77-26858
Proposal for a scroll mode virtual terminal in European informatics network
[EIN/CCG/76/008] N77-26859

DATA RECORDERS
CCD integrated circuit for transient recorders
[UCRL-78360] N77-26398
Development of an optical disc recorder --- using tellurium film
[AD-A037832] N77-26473

DATA REDUCTION
Skylab S191, S192 program descriptions --- earth radiation data analysis
[NASA-CR-152508] N77-26177
A-37B fatigue sensor data analysis methodology program
[AD-A037341] N77-26469
Image processing research --- processing and reducing visual and two dimensional data
[AD-A035315] N77-26947

DATA STORAGE
Simulation of the performance of a collection of storage space allocation algorithms
[UCID-17251] N77-26834

DATA SYSTEMS
Monitor of distributed data systems [MODDS]. Part 1: Digest of functional specifications
[UCID-17314-PT-1] N77-26818
NASA software specification and evaluation system: Software verification/validation techniques
[NASA-CR-150299] N77-26828

DATA TRANSMISSION
Local, regional and large scale integrated networks: Volume 1. Large networks for defense communications: Strategies, performance measures and cost trends
[AD-A035949] N77-26350
Local, regional and large scale integrated networks. Volume 2. Recent advances in ground packet radio systems
[AD-A035950] N77-26351
Local, regional and large scale integrated networks. Volume 3. Recent advances in large scale integrated networks
[AD-A035951] N77-26352
Local, regional and large scale integrated networks; Volume 4. Local and regional communication networks - technologies and architectures
[AD-A035952] N77-26353
Report of the 1976 Joint Workshop on Pattern Recognition and Artificial Intelligence
[AD-A037503] N77-26878
MODSIM: Its application to telecommunications --- simulation of modulated communication channels
N77-26910

DECISION MAKING
Factors affecting the corporate decisionmaking process of air transport manufacturers
[NASA-CR-154618] N77-27020

DECISIONS
Laboratory equipment procurement
[LBL-5504] N77-27022

DECODERS
Three phase full wave dc motor decoder
[NASA-CASE-GSC-11824-1] N77-26386

DECODING
Threaded code for laboratory computers
[AD-A037190] N77-26824

DECOMPOSITION
The manifestation of the kinetic isotope effect during the decomposition of organic macromolecules
[NASA-TT-F-17450] N77-26240
Selective enrichment and isolation of microorganisms on ethyl S-diisopropyl aminoethyl methylphosphonthioate [VX]
[CL-1975-27] N77-26793

DECOMPRESSION SICKNESS
Investigation on the saturation and clearance of hydrogen gas in the brain and extremities of man, and investigations on biomedical monitoring of divers in wet-suits
[AD-A037498] N77-26800

DEFENSE COMMUNICATIONS SYSTEM [DCS]
Local, regional and large scale integrated networks: Volume 1. Large networks for defense communications: Strategies, performance measures and cost trends
[AD-A035949] N77-26350

DEFENSE PROGRAM
Candidate languages evaluation report --- Defense Department requirements
[AD-A037639] N77-26844
Candidate language evaluation and recommendation report --- Defense Department requirements
[AD-A037638] N77-26845

DEGRADATION
Effects of outdoor exposure on solar cell modules in the ERDA/NASA Lewis Research Center Systems Test Facility
[NASA-TM-X-73657] N77-26678

DEGREES OF FREEDOM
Additional degrees of freedom --- and associated task oriented flight control system functions
N77-26166
DEHYDRATION
Hydration-dehydration cycling of MgO-Mg[OH]2 for application to solar heat storage systems
[AI-ERDA-13178] N77-26654
DELAWARE
Application of LANDSAT-2 to the management of Delaware's marine and wetland resources
[E77-10173] N77-26575
DELTA WINGS
An experimental investigation of incompressible flow over delta and double-delta wings
[AD-A035380] N77-26101
DENSE PLASMAS
Strong fast-rising magnetic fields in experiments on heating a dense plasma in a rapid theta pinch
[BLL-CTO-1287-[9091.9F]] N77-26964
DENSITOMETERS
Remote sensing of effects of land use practices on water quality
[NASA-CR-150306] N77-26581
DEPLOYMENT
Effects of weather on NATO/Warsaw pact air/ground operations
[AD-A037313] N77-26775
DEPOLARIZATION
A depolarization and attenuation experiment using the CTS satellite --- meteorological radar
[NASA-CR-152535] N77-26347
Function generator used for dynamic depolarization experiment --- creation of time dependent magnetic fields
[IRI-132-76-03] N77-26401
DESCENT PROPULSION SYSTEMS
Helicopter optimal descent and landing after power loss
[NASA-TM-X-73244] N77-26067
DESERTS
An interpretation of photometric parameters of bright desert regions of Mars and their dependence on wave length
[NASA-TN-D-8446] N77-27054
DESIGN ANALYSIS
Design study of the accessible focal plane telescope for shuttle
[NASA-CR-151440] N77-26943
Conceptual design study of a noncircular Tokamak demonstration fusion power reactor
[GA-A-13992] N77-26981
DEXTRANS
The determination of the molecular weight distribution of polymers by permeation chromatography on porous glass. 1: Dextrans up to a molecular weight of 600000
[BLL-M-24884-[5828.4F]] N77-26246
DICTIONARIES
Speech understanding systems. Volume 3: Lexicon, lexical retrieval and control
[AD-A035167] N77-26361
DIELECTRIC PROPERTIES
Microwave properties of ice from The Great Lakes
[NASA-CR-135222] N77-26577
DIELECTRICS
Water as dielectric in high-voltage impulse devices
[UCRL-TRANS-11185] N77-26395
DIESEL ENGINES
Engine performance and fire-safety characteristics of water-containing diesel fuels
[AD-A036011] N77-26330
DIFFERENTIAL GEOMETRY
Map projection equations
[AD-A037381] N77-26608
DIFFUSE RADIATION
A method to obtain diffuse reflective measurements from 1.0 to 3.0 micrometers using a Cary 17I spectrophotometer
[AD-A035031] N77-26950
DIFFUSION COEFFICIENT
Energy dependent finite element method for two-dimensional diffusion problems
[LA-UR-77-59] N77-26940
DIFFUSION FLAMES
The coherent flame model for turbulent chemical reactions
[AD-A036768] N77-26261
DIGESTING
Fast production of methane by anaerobic digestion
[COO-2900-6] N77-26656
DIGITAL COMMAND SYSTEMS
Engineering of control systems and implications on control law design
N77-26163
Multiple-actuator shaker digital control system
[UCRL-78340] N77-26543
DIGITAL COMPUTERS
Software system of the interferometer computer
N77-26213
Computerized determination of the satellite direction --- for orbit determination using radio interferometer
N77-26214
Evaluation of the Burroughs 3500 CRT Enhancement Program communications system
[AD-A037086] N77-26820
Evaluation of a correction method for digital computer lag in hybrid systems
[SAND-76-0343] N77-26867
Applications of pattern theory to problems in computer science
[AD-A037128] N77-26875
DIGITAL DATA
A four digit memory-mapped display
[NASA-CR-153265] N77-26112
Calculation of performance parameters of an electroexplosive device using digital data techniques
[SAND-76-0373] N77-26323
Digital reconstruction of a coded image obtained with a nonredundant pinhole array
[LA-UR-76-1789] N77-26464
Saturation, heu, and normalized color: Calculation, digitization effects, and use
[AD-A037772] N77-26472
Results from circumsolar radiation measurements
[LBL-5292] N77-26657
DIGITAL FILTERS
Evaluation of an adaptive filter as a digital tracking filter
[SAND-76-5668] N77-26396
A digital detector with selectable passband
[AD-A035604] N77-26409
DIGITAL SYSTEMS
Digital Avionics Information System [DAIS]: Current maintenance task analysis
[AD-A035683] N77-26132
Study, tests, and evaluation for wideband high-density data acquisition [WHIDDA]
[AD-A037410] N77-26822
Image processing research --- processing and reducing visual and two dimensional data
[AD-A035315] N77-26947
DIGITAL TECHNIQUES
A digital detector with selectable passband
[AD-A035604] N77-26409
Computer programs for seismology: Special applications to the high-gain long-period seismic network
[AD-A037963] N77-26751
DIMENSIONAL ANALYSIS
The principles of dimensioning lined circular waveguides
[BLL-PO-3394-[9022.81]] N77-26346
DIODES
Advanced concepts of microwave generation and control in solids
[AD-A037945] N77-26383
DIRECT CURRENT
Three phase full wave dc motor decoder
[NASA-CASE-GSC-11824-1] N77-26386
DIRECT LIFT CONTROLS
Additional degrees of freedom --- and associated task oriented flight control system functions
N77-26166
DIRICHLET PROBLEM
Continuous surface-density Monte Carlo solution to the Dirichlet heat-transfer problem
[AD-A037899] N77-26429
DISCRETE FUNCTIONS
Levinson- and Chandrasekhar-type equations for a general, discrete-time linear estimation problem
[AD-A037678] N77-26902
DISPLAY DEVICES
A four digit memory-mapped display
[NASA-CR-153265] N77-26112
Pilotage navigation utilizing a night-vision system
[AD-A036774] N77-26118
Delay of visual feedback in aircraft simulators
[AD-A037839] N77-26169
Prediction of modulation detectability thresholds for line-scan displays
[AD-A035735] N77-26384
DISSOCIATION
The manifestation of the kinetic isotope effect during the decomposition of organic macromolecules
[NASA-TT-F-17450] N77-26240
Break-up dynamics of polymer beads under laser bombardment
[AD-A037718] N77-26309
Investigation of induced unimolecular decomposition for development of visible chemical lasers
[COO-2920-2] N77-26486
Dissociation of fast molecular-ion beams in thin foils
[CONF-761059-17] N77-26933
DISTRIBUTION [PROPERTY]
Characterization and distribution of lunar mare basalt types using remote sensing techniques
[NASA-CR-153267] N77-27051
DISTRIBUTION FUNCTIONS
An experimental investigation of the distribution function for the near free molecular parallel plate heat transfer problem
[UTIAS-210] N77-26426
DIURNAL VARIATIONS
Meteorological data, series B basic material. Volume 3, no. 4: Daily altitude charts of the 50 mb plane and monthly average charts for the year 1975, part 4
[QR-4-PT-4] N77-26769
Meteorological data, series B basic material. Volume 4, no. 3: Daily altitude charts of the 30 mb plane and monthly average charts for the year 1975, part 3
[QR-3-PT-3] N77-26770
Meteorological data, series B basic material. Volume 4, no. 4: Daily altitude charts of the 30 mb plane and monthly average charts for the year 1975, part 4
[QR-4-PT-4] N77-26771
DOCUMENT STORAGE
Aerial ice reconnaissance and satellite ice information microfilm file
[AD-A037300] N77-26591
DOCUMENTATION
Quantitative methods for software reliability measurements
[AD-A035585] N77-26849
DOCUMENTS
Ames research center publications, 1975
[NASA-TM-X-73245] N77-27063
DOPED CRYSTALS
Neutron transmutation doped silicon solar cells
[CONF-761130-2] N77-26671
DOPPLER NAVIGATION
The transit system, 1975
[AD-A037398] N77-26196
DOUBLE BASE ROCKET PROPELLANTS
A mass spectrometer investigation of the chemistry of plateau burning propellants
[AD-A035602] N77-26332
DRAG CHUTES
The flight test aspects of the Air-Launched Balloon System [ALBS] development program
[AD-A037540] N77-26098
DRAINAGE PATTERNS
Comprehensive study of Leon-Queretaro area --- Mexico
[E77-10154] N77-26569
Application of standard photogeological techniques to LANDSAT imagery for mineral exploration in the basin and range province of Utah and Nevada
[E77-10170] N77-26572
DUCTED FLOW
Study of non-isoenergetic turbulent jet mixing in a constant area duct
[AD-A033498] N77-26446
DYE LASERS
Polychromatic, flashlamp-pumped dye lasers
[AD-A037393] N77-26498
Crystal violet as a mode-locker of the rhodamine 6G dye laser
[AD-A037643] N77-26499
DYNAMIC CHARACTERISTICS
Mathematical investigations of dynamical systems
[AD-A036771] N77-26895
Classical dynamics of triatomic system: Energized harmonic molecules
[CALT-767P4-49] N77-26929
DYNAMIC LOADS
Static and dynamic behavior of noncircular cylindrical shells
[AD-A037673] N77-26562
The stability of a beam subjected to a moving mass
[AD-A037719] N77-26566
DYNAMIC MODELS
Unsteady hovering wake parameters identified from dynamic model tests, part 1
[NASA-CR-152022] N77-26077
Treatment of the nonlinear vibration of a variable sweep aircraft wing with its drive using a simplified wing model
[MBB-UFE-1191[O]] N77-26156
Extended system modelling program - ESMP. Simulation of a large analogue computer on a PDP 11
[OUEL-1178/76] N77-26843
DYNAMIC RESPONSE
Application of light-initiated explosive for simulating X-ray blowoff impulse effects on a full scale reentry vehicle
[SAND-76-9019] N77-26189
Design curves for structural response due to impact loading
[AD-A037011] N77-26513
Identification of natural frequencies and modal damping ratios of aerospace structures from response data
[NASA-CR-151419] N77-26532
Numerical analysis of the dynamic response of elasto-plastic shells
[AD-A035965] N77-26537
Reliability study of SINGER. Volume 1: Validation of model
[AD-A037819] N77-26561
Transient response of continuous elastic structures
[AD-A037001] N77-26565
DYNAMIC STABILITY
Flap/lag/torsion dynamics of a uniform, cantilever rotor blade in hover
[NASA-TM-73248] N77-26068

DYNAMIC STRUCTURAL ANALYSIS
Note on the dynamic buckling of elasto-plastic structures
[AD-A035964] N77-26536
First report on capabilities of dynamic structural analysis by the STRUDL program --- exemplified for frame analysis
[REPT-76-2] N77-26551
The theoretical and experimental dynamic analysis of thin shells of revolution --- using finite element method
N77-26557

E

EARTH ATMOSPHERE
Calculating the ablation of large spheres entering the atmosphere at meteoric velocities
[SAND-76-0311] N77-26178
EARTH CRUST
A dual electro-optical light image receiver and recorder
[AD-A037955] N77-26745
EARTH MOTION
Computer programs for seismology: Special applications to the high-gain long-period seismic network
[AD-A037963] N77-26751
EARTH MOVEMENTS
Resurvey of site stability quadrilaterals, Otay Mountain and Quincy, California --- San Andreas fault experiment
[NASA-CR-149155] N77-26728
EARTH RESOURCES SURVEY PROGRAM
Advanced Sensors and Applications Study [ASAS]
[NASA-CR-151441] N77-26590
ECONOMIC ANALYSIS
An econometric analysis of enroute and terminal air traffic control
[AD-A036892] N77-26119
ECONOMIC FACTORS
Energy situation in New England
[BNL-50580] N77-26650
Factors affecting the corporate decisionmaking process of air transport manufacturers
[NASA-CR-154618] N77-27020
ECONOMICS
AGARD highlights 77/1 --- research and development economics, policies, and the space transportation system
N77-26074
Systems study of fuels from sugarcane, sweet sorghum, sugar beets, and corn
[TID-27336] N77-26324
A social and economic impact study of offshore petroleum and natural gas development in Alaska, phase 1
[PB-264705/5] N77-26677
EDITING ROUTINES [COMPUTERS]
TRIX AC: A set of general purpose text editing commands
[UCID-30040[ED.8]] N77-26836
EDUCATION
Application of remote sensing to state and regional programs
[NASA-CR-153279] N77-26586
EFFUSIVES
Evolution of silicic magma chambers and their relationship to basaltic volcanism
[LA-UR-76-1708] N77-26734
EJECTION
Evaluation of the Harpoon missile shock environment during ejection launch by aircraft launchers
[AD-A037067] N77-26186
ELASTIC BUCKLING
Note on the dynamic buckling of elasto-plastic structures
[AD-A035964] N77-26536
ELASTIC PROPERTIES
Stability of flat, clamped, rectangular sandwich panels subjected to combined inplane loadings
[AD-A037489] N77-26564
KOVEC user's manual --- coding elastic and plastic properties
[UCID-17306] N77-27018
ELASTOMERS
Material studies for protective masks
[AD-A036736] N77-26310
ELASTOPLASTICITY
Calculation of internal weld stresses and weld deformations by means of elasto-plastic finite elements
[BLL-RTS-10440] N77-26530
Note on the dynamic buckling of elasto-plastic structures
[AD-A035964] N77-26536
Numerical analysis of the dynamic response of elasto-plastic shells
[AD-A035965] N77-26537
ELECTRIC BATTERIES
Modified AN/PSM-13 for field testing BA-4386/PRC-25 --- zinc carbon batteries
[AD-A037002] N77-26180
Factors affecting the open-circuit voltage and electrode kinetics of some iron/titanium redox flow cells
[NASA-TM-X-73669] N77-26612
Research and development in the glass fiber sodium-sulfur battery
[AD-A037215] N77-26694
Research and development of the glass fiber sodium-sulfur battery
[AD-A037216] N77-26695
ELECTRIC CONNECTORS
Interference seals and connectors for undersea electrical applications
[AD-A036841] N77-26522
ELECTRIC CONTACTS
Process for preparing liquid metal electrical contact device
[NASA-CASE-LEW-11978-1] N77-26385
ELECTRIC DISCHARGES
Electrostatic changing and discharge phenomena observed in geosynchronous orbit. A bibliography
[ONERA-DERTS-NT-03-11] N77-26388
Electrically initiated HCl chemical laser and threshold excitation of XeF and KrF lasers
[AD-A037732] N77-26481
Plasma chemistry processes in pulsed electric discharge lasers
[AD-A035036] N77-26497
ELECTRIC EQUIPMENT TESTS
Modified AN/PSM-13 for field testing BA-4386/PRC-25 --- zinc carbon batteries
[AD-A037002] N77-26180
ELECTRIC FIELDS
Approximations for terms related to the kernel in thin-wire integral equations
[AD-A036729] N77-26416
Summary of lightning activities by NASA for the Apollo Soyuz test project: Supplement no. 1 to Apollo Soyuz mission evaluation report
[NASA-TM-74755] N77-26729
Magnetospheric magnetic field modeling
[AD-A037492] N77-26740
ELECTRIC FILTERS
Computer-aided analysis of electronic filters
[ESA-TM-171] N77-26399
ELECTRIC GENERATORS
Design and development of a segmented magnet homopolar torque converter
[AD-A037259] N77-26149
Electro-mechanical sine/cosine generator
[NASA-CASE-LAR-11389-1] N77-26387
Energy Conversion Alternatives Study [ECAS], Phase 2. Volume 2: Summary and combined gas-steam turbine plant using coal derived liquid fuel
[NASA-CR-134942-VOL-2] N77-26629
An analysis of the feasibility of windmills for power generation in New York State
[RPI-TA-17] N77-26638
ELECTRIC MOTOR VEHICLES
New batteries and their impact on electric vehicles
[NASA-TM-X-73672] N77-26614
ELECTRIC MOTORS
Design and development of a segmented magnet homopolar torque converter
[AD-A037259] N77-26149
Three phase full wave dc motor decoder
[NASA-CASE-GSC-11824-1] N77-26386
On the calculation of permeances and forces between doubly slotted structures --- reluctance stepping motors
[TH-76-E-65] N77-26400
ELECTRIC POWER PLANTS
Assembly and testing of a 1.8 by 3.7 meter Fresnel lens solar concentrator
[NASA-CR-150300] N77-26610
Energy Conversion Alternatives Study [ECAS], Phase 2. Volume 1: Summary and combined gas-stream turbine plant with an integrated low-BTU gasifier
[NASA-CR-134942-VOL-1] N77-26628
Energy Conversion Alternatives Study [ECAS], Phase 2. Volume 2: Summary and combined gas-steam turbine plant using coal derived liquid fuel
[NASA-CR-134942-VOL-2] N77-26629
Energy Conversion Alternatives Study [ECAS], Phase 2. Volume 3: Summary and advanced steam plant with pressurized fluidized bed boilers
[NASA-CR-134942-VOL-3] N77-26630
Energy Conversion Alternatives Study [ECAS], phase 2. Volume 1: Executive summary
[NASA-CR-134949-VOL-1] N77-26631
Energy Conservation Alternatives Study [ECAS], phase 2: Volume 2: Advanced energy conversion systems, - conceptual designs. Part 1: Analytical approach
[NASA-CR-134949-VOL-2-PT-1] N77-26632
Energy Conversion Alternatives Study [ECAS], phase 2. Volume 2: Advanced energy conversion systems - conceptual designs. Part 2: Closed turbine cycles
[NASA-CR-134949-VOL-2-PT-2] N77-26633
Energy Conversion Alternatives Study [ECAS], phase 2. Volume 2: Advanced energy conversion systems - conceptual designs. Part 3: Open cycle gas turbines and open cycle MHD
[NASA-CR-134949-VOL-2-PT-3] N77-26634
Energy Conversion Alternatives Study [ECAS], phase 2. Volume 2: Advanced energy conversion systems: Conceptual designs. Part 4: Summary of results
[NASA-CR-134949-VOL-2-PT-4] N77-26635
Energy Conversion Alternatives Study [ECAS], phase 2. Volume 3: Research and development plans and implementation assessment
[NASA-CR-134949-VOL-3] N77-26636
Energy Conversion Alternatives Study [ECAS], phase 2. Integrated coal gasifier/molten carbonate fuel cell powerplant conceptual design and implementation assessment
[NASA-CR-134955] N77-26637
Superconducting energy storage development for electric utility systems
[LA-UR-76-2294] N77-26649
Will a rapidly expanding power-generating system be part of the energy problem or part of its solution
[UCRL-78500] N77-26651
Air pollution and the siting of fossil fuel power plants
[ANL-76-XX-14] N77-26708
Improvements to single-source model. Volume 1: Time-concentration relationships
[PB-264686/7] N77-26720
ELECTRIC POWER TRANSMISSION
Air-gapped structures as magnetic elements for use in power processing systems
[NASA-CR-153289] N77-26627
ELECTRIC PROPULSION
Design and development of a segmented magnet homopolar torque converter
[AD-A037259] N77-26149
The ESTEC electric propulsion test facility
N77-26225
Reliability estimating procedures for electric and thermochemical propulsion systems, volume 1
[AD-A037745] N77-26234
Reliability estimating procedures for electric and thermochemical propulsion systems, volume 2
[AD-A037748] N77-26235
ELECTRIC TERMINALS
How to use the CDC 6600 G-machine from a remote terminal
[UCID-30095] N77-26835
ELECTRICAL FAULTS
Functioning of power rectifiers and thyristors --- forward characteristics, shorted emitter, switching response, and reverse capability
[ESA-TT-389] N77-26402
ELECTRICAL MEASUREMENT
Errors in short circuit measurements due to spectral mismatch between sunlight and solar simulators
[NASA-CR-2010] N77-26620
Introduction to basic solar cell measurements
[NASA-CP-2010] N77-26625
Limitation on electrical measures of aerosols
[BNL-21946] N77-26736
ELECTROCHEMICAL CORROSION
Electrochemical investigation of galvanic corrosion of aircraft material couples
[DLR-FB-76-61] N77-26288
ELECTROCHEMISTRY
Electrochemical theory of catalysis in metals
[UCRL-TRANS-11186] N77-26252
Theory and applications of electron transfers at electrodes and in solution
[AD-A037362] N77-26258
Corrosion, stress corrosion cracking, and electrochemistry of the iron and nickel base alloys in caustic environments
[COO-2421-03] N77-26277
Electrochemical investigation of galvanic corrosion of aircraft material couples
[DLR-FB-76-61] N77-26288
Electroinitiated polymerization of monomers on metal electrodes
[AD-A036989] N77-26321
ELECTRODES
Theory and applications of electron transfers at electrodes and in solution
[AD-A037362] N77-26258
Development of all-position coated welding electrode of chromium-enriched cupronickel alloy
[AD-A037150] N77-26306
Square wave voltammetry at the dropping mercury electrode, theoretical
[AD-A035970] N77-26389
The coplanar electron tube
[AD-A037138] N77-26391
Factors affecting the open-circuit voltage and electrode kinetics of some iron/titanium redox flow cells
[NASA-TM-X-73669] N77-26612
ELECTROMAGNETIC ABSORPTION
Non-linear optical amplification and absorption
[AD-A037103] N77-26954
Optical coatings 2-6 microns
[AD-A037257] N77-26961

ELECTROMAGNETIC COMPATIBILITY
Antenna select computer program [ANTSEL]
[AD-A036737] N77-26381
ELECTROMAGNETIC FIELDS
The singularity expansion representation of the transient electromagnetic coupling through a rectangular aperture
[AD-A036999] N77-26374
The singularity expansion representation of the transient electromagnetic coupling through a rectangular aperture
[AD-A037353] N77-26375
State-space solution of transient electromagnetic problems
[AD-A037087] N77-26377
Hot electron production, anomalous absorption, and effect of intense electromagnetic fields on inverse bremsstrahlung absorption near the electron plasma frequency
[LA-UR-76-1951] N77-26982
ELECTROMAGNETIC INTERFERENCE
Antenna select computer program [ANTSEL]
[AD-A036737] N77-26381
ELECTROMAGNETIC RADIATION
Bounce-averaged synchrotron loss in a dipole field
[AD-A037072] N77-26743
ELECTROMAGNETISM
Design, construction, test and field support of a containerless payload package for rocket flight --- electromagnetic heating and confinement
[NASA-CR-149997] N77-26184
ELECTROMECHANICAL DEVICES
Electro-mechanical sine/cosine generator
[NASA-CASE-LAR-11389-1] N77-26387
ELECTRON ACCELERATORS
Compact electron accelerator for pumping gas lasers
[UCRL-78537] N77-26487
ELECTRON BEAMS
Scatha satellite instrumentation report: Thermal plasma analyzer; rapid scan particle detector; electron beam system; positive ion beam system
[AD-A035506] N77-26185
Thermal radiative losses from graphite calorimeters used in pulsed electron beam experiments
[AD-A037754] N77-26475
Application of an electron beam to high density flows of N2, O2 and NO
[AD-A037197] N77-26935
Accelerated electron beam instability in Tokamaks
[BLL-CTO-1262-[9091.9F]] N77-26975
ELECTRON BOMBARDMENT
Ion plating: Concepts and applications
[SAND-76-5459] N77-26515
ELECTRON DENSITY [CONCENTRATION]
Determination of the excited state density distribution within a nonequilibrium, freely expanding argon arcjet plume
[AD-A037352] N77-26145
ELECTRON DISTRIBUTION
Determination of the excited state density distribution within a nonequilibrium, freely expanding argon arcjet plume
[AD-A037352] N77-26145
ELECTRON GUNS
Investigation of coupling of field emission cold cathode guns for gas lasers
[AD-A037734] N77-26510
ELECTRON PLASMA
Hot electron production, anomalous absorption, and effect of intense electromagnetic fields on inverse bremsstrahlung absorption near the electron plasma frequency
[LA-UR-76-1951] N77-26982
ELECTRON STATES
Electronic energy levels in imperfect solids
[AD-A035723] N77-27017
ELECTRON TRANSFER
Theory and applications of electron transfers at electrodes and in solution
[AD-A037362] N77-26258
ELECTRON TRANSITIONS
Electronic energy levels in imperfect solids
[AD-A035723] N77-27017
ELECTRON TUBES
The coplanar electron tube
[AD-A037138] N77-26391
ELECTRONIC EQUIPMENT
Development and qualification of PCM thermal capacitors. Part 1: Development of a 30 Wh PCM thermal capacitor --- temperature control of electronic components
[BMFT-FB-W-76-26-VOL-1] N77-26436
ELECTRONIC MODULES
Development of an integrated power module inverter
[AD-A035815] N77-26403
ELECTRONIC PACKAGING
Interference seals and connectors for undersea electrical applications
[AD-A036841] N77-26522
ELECTRONS
The role of solvated electrons in stress corrosion cracking phenomena. Part 1: Conceptual considerations
[AD-A037527] N77-26297
Correlated electric field and low-energy electron measurements in the low-altitude polar cusp
[NASA-CR-152863] N77-26739
Electronic structure of metals and semiconductors: Bulk, surface, and interface properties
[LBL-5493] N77-26992
ELECTROSLAG REFINING
The grain refinement of electroslag remelted Ni-base alloys --- Inconel 600
N77-26142
ELECTROSTATIC CHARGE
Electrostatic changing and discharge phenomena observed in geosynchronous orbit. A bibliography
[ONERA-DERTS-NT-03-11] N77-26388
ELECTROSTATIC WAVES
Lower hybrid parametric instabilities nonuniform pump waves and Tokamak applications
[PPPL-1308] N77-26976
ELEMENTARY PARTICLES
Lectures on the new particles
[LBL-5500] N77-26939
EMERGENCY LIFE SUSTAINING SYSTEMS
Personal flotation devices research, phase 1
[AD-A037221] N77-26810
EMITTERS
Manufacturing of field emitters
N77-26232
Recent results of tests of experimental cesium field emitters with the ESTEC electric propulsion test facility
N77-26233
ENDOCRINOLOGY
Studies in neuroendocrine pharmacology
[NASA-CR-153278] N77-26795
ENERGY
Environmental considerations of selected energy conserving manufacturing process options. Volume 13: Phosphoric acid industry report
[PB-264279/1] N77-26690
ENERGY BUDGETS
The energy balance in a vortex trail --- of two dimensional bodies
[OUEL-1162/76] N77-26090
ENERGY CONSERVATION
Minimum energy control of a bilinear pursuit-evasion system
[AD-A037556] N77-26187
Regional land use and energy modeling
[BNL-21809] N77-26595
Effects of atmospheric variability on energy utilization and conservation
[COO-1340-52] N77-26646
New energy conservation ideas for existing and new buildings
[CONF-750942-2] N77-26660
Bioconversion of agricultural wastes for pollution control and energy conservation
[TID-27164] N77-26675
Environmental considerations of selected energy conserving manufacturing process options. Volume 2: Industry priority report
[PB-264268/4] N77-26679
Environmental considerations of selected energy conserving manufacturing process options. Volume 3: Iron and steel industry report
[PB-264269/2] N77-26680
Environmental considerations of selected energy conserving manufacturing process options. Volume 4: Petroleum refining industry report
[PB-264270/0] N77-26681
Environmental considerations of selected energy conserving manufacturing process options. Volume 5: Pulp and paper industry report
[PB-264271/8] N77-26682
Environmental considerations of selected energy conserving manufacturing process options. Volume 6: Olefins industry report
[PB-264272/6] N77-26683
Environmental considerations of selected energy conserving manufacturing process options. Volume 7: Ammonia industry report
[PB-264273/4] N77-26684
Environmental considerations of selected energy conserving manufacturing process options. Volume 8: Alumina/aluminum industry report
[PB-264274/2] N77-26685
Environmental considerations of selected energy conserving manufacturing process options. Volume 9: Textile industry report
[PB-264275/9] N77-26686
Environmental considerations of selected energy conserving manufacturing process options. Volume 10: Cement industry report
[PB-264276/7] N77-26687
Environmental considerations of selected energy conserving manufacturing process options. Volume 12: Chlor-alkali industry report
[PB-264278/3] N77-26689
Environmental considerations of selected energy conserving manufacturing process options. Volume 14: Primary copper industry report
[PB-264280/9] N77-26691
Environmental considerations of selected energy conserving manufacturing process options. Volume 15: Fertilizer industry report
[PB-264281/7] N77-26692
The potential of lignocellulosic materials for the production of chemicals, fuels, and energy
[PB-264458/1] N77-26698
Extractives as a renewable resource for industrial materials
[PB-264459/9] N77-26699
ENERGY CONSUMPTION
Techniques for the analysis of total energy and labor of industrial plants
[PB-264221/3] N77-26697
ENERGY CONVERSION EFFICIENCY
Sensitivity of solar-cell performance to atmospheric variables. 1: Single cell
[NASA-CP-2010] N77-26623
Sensitivity of solar-cell performance to atmospheric variables. 2: Dissimilar cells at several locations
[NASA-CP-2010] N77-26624
Energy Conversion Alternatives Study [ECAS], Phase 2. Volume 1: Summary and combined gas-stream turbine plant with an integrated low-BTU gasifier
[NASA-CR-134942-VOL-1] N77-26628
Energy Conversion Alternatives Study [ECAS], Phase 2. Volume 2: Summary and combined gas-steam turbine plant using coal derived liquid fuel
[NASA-CR-134942-VOL-2] N77-26629
Energy Conversion Alternatives Study [ECAS], Phase 2. Volume 3: Summary and advanced steam plant with pressurized fluidized bed boilers
[NASA-CR-134942-VOL-3] N77-26630
Energy Conversion Alternatives Study [ECAS], phase 2. Volume 1: Executive summary
[NASA-CR-134949-VOL-1] N77-26631
Energy Conservation Alternatives Study [ECAS], phase 2: Volume 2: Advanced energy conversion systems, - conceptual designs. Part 1: Analytical approach
[NASA-CR-134949-VOL-2-PT-1] N77-26632
Energy Conversion Alternatives Study [ECAS], phase 2. Volume 2: Advanced energy conversion systems - conceptual designs. Part 2: Closed turbine cycles
[NASA-CR-134949-VOL-2-PT-2] N77-26633
Energy Conversion Alternatives Study [ECAS], phase 2. Volume 2: Advanced energy conversion systems - conceptual designs. Part 3: Open cycle gas turbines and open cycle MHD
[NASA-CR-134949-VOL-2-PT-3] N77-26634
Energy Conversion Alternatives Study [ECAS], phase 2. Volume 2: Advanced energy conversion systems: Conceptual designs. Part 4: Summary of results
[NASA-CR-134949-VOL-2-PT-4] N77-26635
Energy Conversion Alternatives Study [ECAS], phase 2. Volume 3: Research and development plans and implementation assessment
[NASA-CR-134949-VOL-3] N77-26636
Energy Conversion Alternatives Study [ECAS], phase 2. Integrated coal gasifier/molten carbonate fuel cell powerplant conceptual design and implementation assessment
[NASA-CR-134955] N77-26637
Effects of spectral variations on silicon cell output
[SAND-76-9142] N77-26653
ENERGY LEVELS
Correlated electric field and low-energy electron measurements in the low-altitude polar cusp
[NASA-CR-152863] N77-26739
Energy dependent finite element method for two-dimensional diffusion problems
[LA-UR-77-59] N77-26940
Applied research in the general area of charged particle chemistry related to coal-fired MHD
[PB-263873/2] N77-26987
ENERGY POLICY
An analysis of the feasibility of windmills for power generation in New York State
[RPI-TA-17] N77-26638
Silicon solar cell development for concentrated-sunlight, high-temperature applications
[SAND-76-5311] N77-26647
Energy situation in New England
[BNL-50580] N77-26650
Will a rapidly expanding power-generating system be part of the energy problem or part of its solution
[UCRL-78500] N77-26651
Temperature dependence of the photovoltaic performance of Si cells under blue, white, and near-bandgap irradiation
[UCRL-76203] N77-26652
Hydration-dehydration cycling of MgO-Mg[OH]2 for application to solar heat storage systems
[AI-ERDA-13178] N77-26654

Experimental test of gas heat transfer system for hydroxide heat storage
[AI-ERDA-13176] N77-26655
Results from circumsolar radiation measurements
[LBL-5292] N77-26657
New energy conservation ideas for existing and new buildings
[CONF-750942-2] N77-26660
Evaluation of the potential environmental effects of wind energy system development
[ERDA/NSF-07378-75/1] N77-26663
Analysis of thermal performance of Solaris water-trickle solar collector
[CONF-761107-17] N77-26668
Evaluation of Solaris water-trickle solar collector and demonstration of annual cycle collection and storage of solar heated water
[CONF-761143-1] N77-26669
Research and development of low cost processes for integrated solar arrays
[COO-2721-76-1] N77-26670
Study of corrosion and its control in aluminum solar collectors
[COO-2934-76-1] N77-26673
General Electric Company survey to define impact of statewide building codes on solar HVAC systems, commercial buildings. National Solar Demonstration Program
[COO-2683-76-11] N77-26674
Bioconversion of agricultural wastes for pollution control and energy conservation
[TID-27164] N77-26675
Comparative performance of solar heating with air liquid systems
[COO-2868-1] N77-26676
The potential of lignocellulosic materials for the production of chemicals, fuels, and energy
[PB-264458/1] N77-26698
Energy and physics
[ERDA-TR-225] N77-26916

ENERGY SOURCES
CDIF combustor design
[TID-27143] N77-26393
Energy and physics
[ERDA-TR-225] N77-26916

ENERGY STORAGE
Principal considerations in large energy-storage capacitor banks
[LA-UR-76-2387] N77-26392
Research on high-energy storage for laser amplifiers
[UCRL-13708] N77-26488
Analysis of magnetic suspension --- for energy storage by rotating cylinders
[SAND-76-0532] N77-26648
Superconducting energy storage development for electric utility systems
[LA-UR-76-2294] N77-26649
Hydrogen storage via metal hydrides for utility and automotive energy storage applications
[BNL-21723] N77-26666

ENERGY TECHNOLOGY
Energy and physics
[ERDA-TR-225] N77-26916

ENERGY TRANSFER
Far infrared chemical lasers
[COO-2523-8] N77-26483

ENGINE DESIGN
Performance, emissions, and physical characteristics of a rotating combustion aircraft engine
[NASA-CR-135119] N77-26134
Design of turbofan engine controls using output feedback regulator theory
[NASA-TM-X-73622] N77-26136
Advanced thrust chamber technology
[NASA-CR-135221] N77-26221
Computed ion trajectories in thrustor beams
N77-26229
Recent results of tests of experimental cesium field emitters with the ESTEC electric propulsion test facility
N77-26233

ENGINE NOISE
Noise measurements of a Cullum detuner at the Woensdrecht airfield --- test of J-79 engine
[IZF-1976-4] N77-26921

ENGINE TESTS
Performance, emissions, and physical characteristics of a rotating combustion aircraft engine
[NASA-CR-135119] N77-26134
Noise measurements of a Cullum detuner at the Woensdrecht airfield --- test of J-79 engine
[IZF-1976-4] N77-26921

ENGINEERING DRAWINGS
CDSLG: An interactive program for the description of circuits
N77-26912

ENVIRONMENT EFFECTS
Oversight hearings on the SST
[GPO-76-492] N77-26107
Environmental considerations of selected energy conserving manufacturing process options. Volume 4: Petroleum refining industry report
[PB-264270/0] N77-26681
Environmental considerations of selected energy conserving manufacturing process options. Volume 5: Pulp and paper industry report
[PB-264271/8] N77-26682
Environmental considerations of selected energy conserving manufacturing process options. Volume 6: Olefins industry report
[PB-264272/6] N77-26683
Environmental considerations of selected energy conserving manufacturing process options. Volume 7: Ammonia industry report
[PB-264273/4] N77-26684
Environmental considerations of selected energy conserving manufacturing process options. Volume 8: Alumina/aluminum industry report
[PB-264274/2] N77-26685
Environmental considerations of selected energy conserving manufacturing process options. Volume 9: Textile industry report
[PB-264275/9] N77-26686
Environmental considerations of selected energy conserving manufacturing process options. Volume 10: Cement industry report
[PB-264276/7] N77-26687
Environmental considerations of selected energy conserving manufacturing process options. Volume 11: Glass industry
[PB-264277/5] N77-26688
Environmental considerations of selected energy conserving manufacturing process options. Volume 12: Chlor-alkali industry report
[PB-264278/3] N77-26689
Environmental considerations of selected energy conserving manufacturing process options. Volume 13: Phosphoric acid industry report
[PB-264279/1] N77-26690
Environmental considerations of selected energy conserving manufacturing process options. Volume 14: Primary copper industry report
[PB-264280/9] N77-26691
Environmental considerations of selected energy conserving manufacturing process options. Volume 15: Fertilizer industry report
[PB-264281/7] N77-26692
Transportation-related data bases extracted from the national index of energy and environmental data bases. Part 1: Digest of detailed data base descriptions
[UCID-17316-PT-1] N77-27036
Transportation-related data bases extracted from the national index of energy and environmental data bases. Part 2: Detailed data base descriptions
[UCID-17316-PT-2] N77-27037

ENVIRONMENT MODELS
Regional land use and energy modeling
[BNL-21809] N77-26595

ENVIRONMENT PROTECTION
Evaluation of the potential environmental effects of wind energy system development
[ERDA/NSF-07378-75/1] N77-26663
Environmental considerations of selected energy conserving manufacturing process options. Volume 2: Industry priority report
[PB-264268/4] N77-26679

ENVIRONMENTAL MONITORING
Land development in the Daly Basin
[E77-10155] N77-26570
Land development in the Daly Basin
[E77-10156] N77-26571
Development and application of operational techniques for the inventory and monitoring of resources and uses for the Texas coastal zone
[E77-10174] N77-26576
Short- and long-term dispersion factors for calculating the environmental burden due to exhaust air streams
[ORNL-TR-4234] N77-26711

ENVIRONMENTAL TESTS
Preliminary results of accelerated exposure testing of solar cell system components
[NASA-TM-X-73674] N77-26615

ENZYMES
Enzyme process design for water treatment
[PB-264504/2] N77-27039

EPITAXY
Research study in growth of aluminum-nitride on sapphire piezoelectric films
[AD-A037793] N77-26307

EPOXY RESINS
Lap shear strength of selected adhesives [epoxy, varnish, B-stage glass cloth] in liquid nitrogen and at room temperature
[ORNL/TM-5658] N77-26312
Laminated beams: Deflection and stress as a function of epoxy shear modulus
[PPPL-1287] N77-26313

EQUATIONS OF MOTION
Numerical integration of the governing equations for the domain of pure supersonic flows --- at pointed or blunt bodies
[ESA-TT-380] N77-26092
Numerical solution of the spray equation
[UCID-17361] N77-26517
Materials applications and mathematical properties of the rational polynomial creep equation
[ORNL-5202] N77-26545
The influence of support characteristics on the stability of an elastic system subjected to a circulatory force
[AD-A037929] N77-26918

EQUATIONS OF STATE
Measurement of an equation-of-state point for molybdenum at very high pressure
[LA-UR-76-2286] N77-26280
State-space solution of transient electromagnetic problems
[AD-A037087] N77-26377

EQUILIBRIUM FLOW
Equilibrium and MHD stability of a plasma in stellarators with three-dimensional axes
[BLL-RISLEY-TR-1285-[9091.9F]]
N77-26967

EQUINOXES
Specular reflection timing predictions for the period preceding the 1977 vernal equinox
[AD-A036982] N77-26188

ERROR ANALYSIS
Instrumentation calibration --- national and international standardization for laboratory equipment
[LBL-5506] N77-26466
A microprocessor-based bit error performance monitor
[AD-A037612] N77-26825

ERROR SIGNALS
Evaluation of an adaptive filter as a digital tracking filter
[SAND-76-5668] N77-26396

ESSA 8 SATELLITE
Meteorological data, series B basic material. Volume 5, no. 3: European climatology 1975. Weather satellite data received in the Berlin area, part 3 --- ESSA 8 daily APT data
[QR-3-PT-3] N77-26772
Meteorological data, series B basic material. Volume 5, no. 4: European climatology 1975. Weather satellite data received in the Berlin area, part 4 --- ESSA 8 and NOAA 4 daily data
[QR-4-PT-4] N77-26773

ESTERS
Fluorodinitro silicon compounds. Part 1: Organosilicon and silicate esters of 2,2,2-fluorodinitroethanol. Part 2: Nonhydrolyzable silanes
[AD-A037464] N77-26335

ESTIMATES
A Monte-Carlo study of robust estimators of location
[AD-A035739] N77-26899

ESTIMATING
Levinson- and Chandrasekhar-type equations for a general, discrete-time linear estimation problem
[AD-A037678] N77-26902

ESTUARIES
Applications of remote sensing to estuarine management
[NASA-CR-153287] N77-26585

EULER EQUATIONS OF MOTION
Euler angles, quaternions, and transformation matrices for space shuttle analysis
[NASA-CR-151435] N77-26175
The general solution to the classical problem of finite Euler Bernoulli beam
[NASA-TM-X-73253] N77-26533

EUROPE
A comparison of the USAF projected A-10 employment in Europe and the Luftwaffe Schlachtgeschwader experience on the eastern front in World War II
[AD-A036863] N77-26125
Field emission day --- conference proceedings, ESTEC, Noordwijk, Apr. 1976
[ESA-SP-119] N77-26223
Observations on European low-temperature physics research: An annotated directory of low-temperature physics in British universities and some comments on the low temperature physics programs in Europe
[AD-A036959] N77-26339
Meteorological data, series B basic material. Volume 5, no. 3: European climatology 1975. Weather satellite data received in the Berlin area, part 3 --- ESSA 8 daily APT data
[QR-3-PT-3] N77-26772
Meteorological data, series B basic material. Volume 5, no. 4: European climatology 1975. Weather satellite data received in the Berlin area, part 4 --- ESSA 8 and NOAA 4 daily data
[QR-4-PT-4] N77-26773
An extended set of cosmic ray variational coefficients for European cosmic ray stations
[AD-A036992] N77-27062

EUROPEAN SPACE AGENCY
Overall view of computer-aided analysis at ESTEC
N77-26905

EUROPEAN SPACE PROGRAMS
Field emission day --- conference proceedings, ESTEC, Noordwijk, Apr. 1976
[ESA-SP-119] N77-26223

EVACUATING [TRANSPORTATION]
Aeromedical evaluation of UH-1 internal advanced personnel rescue hoists, Western Gear Corporation hoist models 42277R1 and 42305R1, Breeze Corporation hoist ECP-720 modification
[AD-A037621] N77-26130

EVALUATION
Application and performance of rare gas oxide amplifiers
[UCRL-78483] N77-26484
LANDSAT-1 and LANDSAT-2 flight evaluation report
[NASA-CR-152475] N77-26594
EVAPORATIVE COOLING
Heat transfer and pressure loss caused by coolant vaporization in a horizontal stream tube
[BLL-RTS-9956] N77-26419
EVASIVE ACTIONS
Minimum energy control of a bilinear pursuit-evasion system
[AD-A037556] N77-26187
EXCITATION
Accelerator based atomic physics experiments: An overview
[CONF-761059-6] N77-26932
EXHAUST GASES
A fluidic fuel and air bleed load control system for gas turbine engines
[AD-A035701] N77-26141
Analysis and testing of JP-5 fuel derived from coal
[AD-A036073] N77-26333
Application of the initial plume angle correlation to correct nozzle/aftbody pressure drag for hot exhaust gas effects
[AD-A037471] N77-26454
A laser Raman system for obtaining N2 and CO2 concentrations in probe-sampled combustion gases
[AD-A037563] N77-26502
Short- and long-term dispersion factors for calculating the environmental burden due to exhaust air streams
[ORNL-TR-4234] N77-26711
EXHAUST NOZZLES
Application of the initial plume angle correlation to correct nozzle/aftbody pressure drag for hot exhaust gas effects
[AD-A037471] N77-26454
EXOSAT SATELLITE
Optimization of the parameters of a stellar sensor, used for attitude reconstitution of a satellite --- Exosat mission
[N-30-486-0] N77-26191
Exosat thermal distorsions --- finite element structural model
[FOK-RV-76-56] N77-26548
EXPLORATION
Geochemistry and hydrothermal alteration at selected Utah hot springs, volume 3
[PB-264415/1] N77-26606
A social and economic impact study of offshore petroleum and natural gas development in Alaska, phase 2
[PB-264706/3] N77-26693
EXPLOSIVE DEVICES
VISAR measurements of velocities in explosive valves
[SAND-76-8048] N77-26460
EXPLOSIVES
Calculation of performance parameters of an electroexplosive device using digital data techniques
[SAND-76-0373] N77-26323
Determination of negative ion mass spectra of some explosives --- ortho-, para-, di- and trinitrotoluene
[ISL-R-126/75] N77-26327
Fluorodinitro silicon compounds. Part 1: Organosilicon and silicate esters of 2,2,2-fluorodinitroethanol. Part 2: Nonhydrolyzable silanes
[AD-A037464] N77-26335
EXPONENTIAL FUNCTIONS
Best rational approximations with negative poles to e to the -x power on [0, infinity]
[AD-A037559] N77-26888
EXPOSURE
Effects of outdoor exposure on solar cell modules in the ERDA/NASA Lewis Research Center Systems Test Facility
[NASA-TM-X-73657] N77-26678
EXTERNAL STORES
Aerodynamic interference of two axisymmetric stores at low supersonic speeds
[AD-A036900] N77-26100
EXTERNALLY BLOWN FLAPS
Static, noise, and transition tests of a combined-surface-blowing V/STOL lift/propulsion system
[NASA-CR-151954] N77-26139
EXTINGUISHING
Quenched flames with inhibitors: A theoretical analysis [theoretical analysis of quenched flames]
[BNL-21977] N77-26254
EXTRAPOLATION
A comparison of two independent measurements and analysis of jet aircraft flyover noise
[NASA-TN-D-8379] N77-26920
EYE [ANATOMY]
Optical hazards of weather service instrumentation, January 1977
[AD-A037617] N77-26507
Evaluation of a laser equipped rifle for the US Army Human Engineering Laboratory, Aberdeen Proving Ground, Maryland, 19 January 1977
[AD-A037615] N77-26508

F

F-14 AIRCRAFT
The effect of reliability and maintainability on the F-14A TF30P412A engine
[AD-A037985] N77-26525
F-28 TRANSPORT AIRCRAFT
Structural analysis of a wing part using the ASKA program system --- F-28 aircraft
[NLR-TR-73030-U] N77-26549
FABRICATION
Research and development of low cost processes for integrated solar arrays
[COO-2721-76-1] N77-26670
Planar CMOS/SOS array development
[AD-A037752] N77-27009
FABRY-PEROT INTERFEROMETERS
An experimental investigation of the distribution function for the near free molecular parallel plate heat transfer problem
[UTIAS-210] N77-26426
FAILURE
Preliminary Failure Modes, Effects and Criticality Analysis [FMECA] of the Conceptual Brayton Isotope Power System [BIPS] flight system
[TID-27251] N77-26643
FAILURE ANALYSIS
Examination of a failed transition weld joint and the associated base metals
[ORNL-5223] N77-26278
Failure analysis of pressure vessels with defects --- maraging steel plate specimens
[OUEL-1168/76] N77-26550
FAILURE MODES
Reliability data for fluidic systems
[AD-A035724] N77-26451
FAR INFRARED RADIATION
Far infrared chemical lasers
[COO-2523-8] N77-26483
FARM CROPS
Analysis of significance within crop-spectra: A comparison study of different multispectral scanners
[NIWARS-PUBL-30] N77-26596
Use of crop-weather models for assessing potential agricultural production
[REPT-891] N77-26756
FAST FOURIER TRANSFORMATIONS
Time evolving spectra
[AD-A037151] N77-26893
FATIGUE [MATERIALS]
Biaxial fatigue loading of notched composites
[NASA-CR-145198] N77-26241
Correlation of high- and low-cycle fatigue data for Incoloy-800H
[BNL-NUREG-50574] N77-26282
A-37B fatigue sensor data analysis methodology program
[AD-A037341] N77-26469
Concept of frequency separation in life prediction for time-dependent fatigue
[CONF-761107-14] N77-26542
Development of simplified analysis methods for ratchetting and creep fatigue
[CONF-761107-6] N77-26546
FATIGUE LIFE
Fatigue behavior of welded joints in Al Zn Mg1, Al Zn4 Mg1, and Al Mg Si [tables and diagrams]
[REPT-76-5-VOL-2] N77-26555
FATIGUE TESTS
Fatigue investigation of the C-2A nose landing gear
[AD-A037901] N77-26126
Effect of lack of penetration on fatigue resistance of high-strength structural steel welds
[AD-A037047] N77-26302
FEASIBILITY
Evaluation of the technical and economic feasibility of mirror fusion devices
[UCRL-13695] N77-26977
FEASIBILITY ANALYSIS
Preliminary analysis and feasibility study on high speed turbulence generator
[UCID-17291] N77-26433
Investigation of possibilities for solar powered high energy lasers in space
[NASA-CR-153271] N77-26478
An analysis of the feasibility of windmills for power generation in New York State
[RPI-TA-17] N77-26638
FEEDBACK
Delay of visual feedback in aircraft simulators
[AD-A037839] N77-26169
FEEDBACK CONTROL
Design of turbofan engine controls using output feedback regulator theory
[NASA-TM-X-73622] N77-26136
Two-dimensional delta-mod facsimile coding
[UCRL-77999] N77-26840
FTANAL: Computer-aided analysis of continuous and sampled linear control systems --- based on transfer functions
N77-26911
FERMENTATION
Bioconversion of agricultural wastes for pollution control and energy conservation
[TID-27164] N77-26675
FERROELECTRICITY
Concerning the existence of two ferroresonance regimes
[BLL-CE-TRANS-6837-[9022.09]]
N77-26915
FERROMAGNETIC RESONANCE
Concerning the existence of two ferroresonance regimes
[BLL-CE-TRANS-6837-[9022.09]]
N77-26915
FERTILIZERS
Environmental considerations of selected energy conserving manufacturing process options. Volume 15: Fertilizer industry report
[PB-264281/7] N77-26692
FIBER OPTICS
Theoretical studies of fiber optical waveguides and integrated optical circuits
[AD-A035643] N77-26955
FIELD COILS
Laminated beams: Deflection and stress as a function of epoxy shear modulus
[PPPL-1287] N77-26313
FIELD EFFECT TRANSISTORS
Excess noise in selected field-effect transistors
[LBL-5567] N77-26394
X-band power FET development
[AD-A035642] N77-26410
FIELD EMISSION
Field emission day --- conference proceedings, ESTEC, Noordwijk, Apr. 1976
[ESA-SP-119] N77-26223
Review of past and present research studies on ion field emission
N77-26224
Mechanisms of ion emission from liquid cesium
N77-26226
Experiments with field emission ion sources
N77-26227
Field emission study
N77-26231
Manufacturing of field emitters
N77-26232
Recent results of tests of experimental cesium field emitters with the ESTEC electric propulsion test facility
N77-26233
An investigation of basic noise properties of field emission
[AD-A037094] N77-26390
Investigation of coupling of field emission cold cathode guns for gas lasers
[AD-A037734] N77-26510
FILES
Research on large file management information systems
[AD-A037161] N77-27024
FILM COOLING
Plugging of cooling holes in film-cooled turbine vanes
[NASA-TM-X-73661] N77-26269
FILTERS
Use of X-ray scattering in absorption corrections for X-ray fluorescence analysis of loaded filters
[BNWL-SA-5755] N77-26249
Optimal prefiltering for spline reconstruction
[AD-A037504] N77-26891
FILTRATION
Aerosol research and development related to health hazards analysis
[LA-6539-PR] N77-26703
FINITE DIFFERENCE THEORY
Numerical methods in hydrodynamic calculations
[UCRL-52112] N77-26430
Analysis of an unsteady numerical scheme for calculation of transonic flow --- cascade flow
N77-26444
A finite difference scheme for the calculation of supersonic three dimensional flow fields around blunt bodies
[ESA-TT-366] N77-26445
Solution of transient problems in free surface hydrodynamics
[AD-A037717] N77-26452
A diffusion-deposition scheme for use within the ARL trajectory model
[PB-264788/1] N77-26722
An implicit, compact, finite difference method to solve hyperbolic equations
[VKI-TN-119] N77-26885
FINITE ELEMENT METHOD
Finite element stability analysis for coupled rotor and support systems
[NASA-CR-152024] N77-26079
Construction of the three-dimensional numerical model of an automotive wheel hub
N77-26518
Calculation of internal weld stresses and weld deformations by means of elasto-plastic finite elements
[BLL-RTS-10440] N77-26530
The general solution to the classical problem of finite Euler Bernoulli beam
[NASA-TM-X-73253] N77-26533
Nonlinear analysis of bonded joints with thermal effects
[NASA-CR-153263] N77-26534

Exosat thermal distorsions — finite element structural model
[FOK-RV-76-56] N77-26548
Structural analysis of a wing part using the ASKA program system — F-28 aircraft
[NLR-TR-73030-U] N77-26549
The theoretical and experimental dynamic analysis of thin shells of revolution — using finite element method
N77-26557
Application of hybrid finite elements to structure mechanics problems
[AD-A038016] N77-26563
Energy dependent finite element method for two-dimensional diffusion problems
[LA-UR-77-59] N77-26940

FINNED BODIES
The aerodynamic characteristics of wrap-around fins at Mach numbers of 0.3 to 3.0
[AD-A036715] N77-26086

FINS
Experimental investigation of hydrodynamic coefficients of a small-waterplane area, twin-hull model
[AD-A035908] N77-26338

FIRE CONTROL
An improved method of determining shock test specifications for fire control equipment
[AD-A037618] N77-26538

FIRE FIGHTING
Development of smoke abated aircraft crash/rescue fire fighting trainer
[AD-A035999] N77-26260
Non-reflective, wettable, fibrous fabric assemblies for firefighters' clothing
[AD-A038028] N77-26320

FIRES
Engine performance and fire-safety characteristics of water-containing diesel fuels
[AD-A036011] N77-26330

FLAME PROPAGATION
Unsteady flow and flame propagation in a prechamber of a stratified charge engine
[SAND-75-8743] N77-26250

FLAMMABLE GASES
Explosive tests for establishing hazard classification for M1 SP propellant in automated single-base finishing operations
[AD-A037383] N77-26336

FLASH LAMPS
Polychromatic, flashlamp-pumped dye lasers
[AD-A037393] N77-26498

FLIGHT CHARACTERISTICS
LANDSAT-1 and LANDSAT-2 flight evaluation report, 23 July - 23 October 1976
[NASA-CR-152474] N77-26593

FLIGHT CONTROL
Present-day role of control and stability augmentation systems and future trends
[MBB-UFE-1182[O]] N77-26155
The effectiveness of canards for roll control
[AD-A037077] N77-26160
Task-Oriented Flight Control Systems
[AGARD-LS-89] N77-26161
Task-Oriented Flight Control Systems: Introduction and overview — aircraft control
N77-26162
Engineering of control systems and implications on control law design
N77-26163
The need for task oriented control laws
N77-26164
Implementation of task-oriented control laws
N77-26165
Additional degrees of freedom — and associated task oriented flight control system functions
N77-26166
Bibliography on task-oriented flight control systems
N77-26167

FLIGHT HAZARDS
Annual review of aircraft accident data, US air carrier operations, 1975
[PB-264346/8] N77-26110

FLIGHT OPTIMIZATION
Updated dispersion analysis for the first Orbital Flight Test [OFT-1] mission
[NASA-CR-151434] N77-26174

FLIGHT SIMULATION
Aviation simulation master plan, phase 1. Volume 1
[AD-A037803] N77-26172
Project DAME: Tactical instrumented missile simulation testing
[AD-A035600] N77-26192

FLIGHT SIMULATORS
Application of system identification to analytic rotor modeling from simulated and wind tunnel dynamic test data, part 2
[NASA-CR-152023] N77-26078
An experimental investigation using a normal jet plume simulator to determine jet plume effects on a long slender rocket configuration at Mach numbers from 0.2 to 1.5
[AD-A037735] N77-26093
Delay of visual feedback in aircraft simulators
[AD-A037839] N77-26169
Maximizing flight fidelity integration of Naval Air Test Center capabilities into the procurement of major aviation training devices
[AD-A037687] N77-26173

FLIGHT STABILITY TESTS
Finite element stability analysis for coupled rotor and support systems
[NASA-CR-152024] N77-26079

FLIGHT TESTS
Skyhook 1976
[AD-A037419] N77-26094
The flight test aspects of the Air-Launched Balloon System [ALBS] development program
[AD-A037540] N77-26098
Flight test results of the Strapdown hexad Inertial Reference Unit [SIRU]. Volume 1: Flight test summary
[NASA-TM-73163] N77-26111
Flight test evaluation of Slant Visual Range/Approach Light Contact Height [SVR/ALCH] measurement system
[AD-A038183/0] N77-26113
Flight test data for light aircraft spoiler roll control systems
[NASA-CR-153291] N77-26122
Model structure determination and test input selection for identification of nonlinear regimes
[AD-A037831] N77-26131
Description and flight tests of an oculometer
[NASA-TN-D-8419] N77-26154
A comparison of two independent measurements and analysis of jet aircraft flyover noise
[NASA-TN-D-8379] N77-26920

FLIGHT TRAINING
Aviation simulation master plan, phase 1. Volume 1
[AD-A037803] N77-26172
A-6E systems approach to training, phase 1
[AD-A037468] N77-26803

FLOATING
An integrated circuit floating point accumulator
[NASA-TN-D-8509] N77-27046

FLOOD CONTROL
A test of the use of thermistor sensors for measuring small rates of water flow
[BLL-RTS-10421] N77-26455

FLORIDA
The use of remote sensing in solving Florida's geological and coastal engineering problems
[NASA-CR-153286] N77-26584
Basic hydrogeologic and remote sensing data for selection of sanitary landfill sites
[NASA-CR-153280] N77-26587

FLOW DISTRIBUTION
An experimental investigation of incompressible flow over delta and double-delta wings
[AD-A035380] N77-26101
Wind tunnel wall effects — adaptive flow distribution
[AD-A037532] N77-26103
The influence of boundary point procedures on accuracy and efficiency in flow field calculations
[DOC-77SDR016] N77-26424
A finite difference scheme for the calculation of supersonic three dimensional flow fields around blunt bodies
[ESA-TT-366] N77-26445

FLOW STABILITY
Ionization instability of a non-self-sustaining discharge due to step ionization — of gas mixtures
[BLL-CTO-1267-[9091.9F]] N77-26974

FLOW VELOCITY
Prediction of test cell visible emissions
[AD-A037694] N77-26146
The effects of sintering parameters and particle size distribution on P/M steel forgings
[AD-A036983] N77-26303

FLUID DYNAMICS
The initial roll-up of a thick, two-dimensional wake behind a wing of finite span
[AD-A037033] N77-26104
Fine scale structure of turbulent velocity fields
[AD-A035738] N77-26450

FLUIDIC CIRCUITS
Reliability data for fluidic systems
[AD-A035724] N77-26451

FLUIDIZED BED PROCESSORS
Energy Conversion Alternatives Study [ECAS], Phase 2. Volume 3: Summary and advanced steam plant with pressurized fluidized bed boilers
[NASA-CR-134942-VOL-3] N77-26630

FLUORIDES
The structure of a mixed-valence iron fluoride, Fe2F5.2H2O
[AD-A035714] N77-26266

FLUORINE
Inorganic halogen oxidizer research
[AD-A037421] N77-26259

FLUORO COMPOUNDS
Fluorodinitro silicon compounds. Part 1: Organosilicon and silicate esters of 2,2,2-fluorodinitroethanol. Part 2: Nonhydrolyzable silanes
[AD-A037464] N77-26335

FLUOROHYDROCARBONS
New materials for fluorosulfonic acid electrolyte fuel cells
[AD-A036988] N77-26640

FLUTTER ANALYSIS
Simulation of sub-span galloping of bundled conductors: A simplified model
[BLL-CE-TRANS-7067-[9022.09]] N77-26417

FOG
An approach to the short-range prediction of early morning radiation fog
[AD-A037961] N77-26765

FOILS [MATERIALS]
Zirconia-foil compatibility test. Phase 1
[TE-4219-28-77] N77-26645
Dissociation of fast molecular-ion beams in thin foils
[CONF-761059-17] N77-26933

FOOD
Scientific lectures on meteorology — conference proceedings, Geneva, May 1975
[WMO-435] N77-26754
Meteorology and hydrology in aid of food production
N77-26755

FORCE DISTRIBUTION
On the calculation of permeances and forces between doubly slotted structures — reluctance stepping motors
[TH-76-E-65] N77-26400

FORECASTING
Everyman's guide to TIMES
[AD-A035733] N77-26850

FOREIGN BODIES
Calculating the ablation of large spheres entering the atmosphere at meteoric velocities
[SAND-76-0311] N77-26178

FORMAT
Computer Output Microforms Program And Concept Study [COMPACS] report
[AD-A035992] N77-27029

FORTRAN
GRAPHELP user's manual: Version 2 — FORTRAN
[AD-A037564] N77-26826
Optimization guide for programs compiled under IBM FORTRAN H [OPT=2]
[NASA-TM-X-71307] N77-26827

FOSSIL FUELS
Air pollution and the siting of fossil fuel power plants
[ANL-76-XX-14] N77-26708

FOUNDATIONS
Vibration characteristics of a large wind turbine tower on non-rigid foundations
[NASA-TM-X-73670] N77-26613

FRACTURE MECHANICS
Irradiated dynamic fracture toughness of ASTM A533 grade B, class 1 steel plate and submerged arc weldment
[ORNL/SUB-3720-1] N77-26274
A comparison of the effects of specimen thickness and subcritical crack growth on several nonlinear fracture toughness parameters
[AD-A037470] N77-26296
Materials and mechanics of rate effects in brittle fracture
[COO-2422-08] N77-26541
Application of hybrid finite elements to structure mechanics problems
[AD-A038016] N77-26563

FRACTURE STRENGTH
Irradiated dynamic fracture toughness of ASTM A533 grade B, class 1 steel plate and submerged arc weldment
[ORNL/SUB-3720-1] N77-26274
Effect of percentage bainite formed at 400 deg C on the fracture toughness properties of as-quenched HY130
[AD-A035948] N77-26291

FRACTURES [MATERIALS]
Creep, cyclic creep, and fatigue fracture in a low alloy steel — creep crack propagation
N77-26289

FRAMES
First report on capabilities of dynamic structural analysis by the STRUDL program — exemplified for frame analysis
[REPT-76-2] N77-26551

FRAMING CAMERAS
Acoustical high speed holographic framing camera
[SAND-76-5886] N77-26468

FREE FALL
Calculating the ablation of large spheres entering the atmosphere at meteoric velocities
[SAND-76-0311] N77-26178

FREE JETS
Calculation of underexpanded jets issuing from supersonic nozzles — noting position of jet boundary and application to hydrazine spacecraft propulsion engines
[REPT-75-4] N77-26438

FREQUENCIES
Concept of frequency separation in life prediction for timecdependent fatigue
[CONF-761107-14] N77-26542
FREQUENCY CONTROL
The application of the Routh approximation method to turbofan engine models
[NASA-TM-X-73623] N77-26137
FREQUENCY CONVERTERS
The 10.6 micron parametric frequency converter
[AD-A035040] N77-26495
FREQUENCY RANGES
Identification of natural frequencies and modal damping ratios of aerospace structures from response data
[NASA-CR-151419] N77-26532
FUEL CELLS
New materials for fluorosulfonic acid electrolyte fuel cells
[AD-A036988] N77-26640
Fuel cell stacks
[AD-A037586] N77-26641
FUEL CONSUMPTION
Techniques for the analysis of total energy and labor of industrial plants
[PB-264221/3] N77-26697
FUEL SYSTEMS
A fluidic fuel and air bleed load control system for gas turbine engines
[AD-A035701] N77-26141
FUELS
Effect of naphthols on the thermal stability of fuels
[NASA-TT-F-17302] N77-26322
Systems study of fuels from sugarcane, sweet sorghum, sugar beets, and corn
[TID-27336] N77-26324
Status of laser fusion
[UCRL-77056] N77-26938
FUNCTION GENERATORS
Function generator used for dynamic depolarization experiment --- creation of time dependent magnetic fields
[IRI-132-76-03] N77-26401
FUNCTIONAL ANALYSIS
Likelihood ratios for time-continuous data models: The white noise approach
[AD-A037764] N77-26887
FURNACES
High pressure furnace growth of mercury cadmium telluride
[AD-A036918] N77-26294

G

GALLIUM ARSENIDES
Development of gallium arsenide for infrared windows
[AD-A037336] N77-26957
Oxide barriers on a GaAs by neutralized ion beam sputtering
[NASA-CR-152866] N77-27007
Ion implantation in compound semiconductors
[AD-A037958] N77-27010
GALLIUM SELENIDES
Resonant Raman scattering in GaSe and GaS[x]Se[1-x]
[LBL-5456] N77-26993
Optical properties of layer compounds Ga s sub'x Se sub 1-x
[LBL-5464] N77-26994
GAMMA RAYS
Cesium-137 whole-body content in a normal New Mexico population
[LA-UR-76-2097] N77-26798
X-ray and gamma-ray line production by nonthermal ions
[NASA-TM-X-71335] N77-27061
GAPS
Reluctance technique for approximating the performance of large air gap transformers
[SAND-76-0589] N77-26397
GAS ANALYSIS
A laser Raman system for obtaining N2 and CO2 concentrations in probe-sampled combustion gases
[AD-A037563] N77-26502
Measurement techniques for inorganic trace materials in control system streams
[PB-264345/0] N77-26714
GAS DISCHARGES
Ionization instability of a non-self-sustaining discharge due to step ionization --- of gas mixtures
[BLL-CTO-1267-[9091.9F]] N77-26974
GAS DYNAMICS
Comparison between two gas dynamic computation models of interior ballistics
[ISL-CO-219/76] N77-26328
GAS EXCHANGE
Investigation on the saturation and clearance of hydrogen gas in the brain and extremities of man, and investigations on biomedical monitoring of divers in wet-suits
[AD-A037498] N77-26800
GAS GENERATORS
Inorganic halogen oxidizer research
[AD-A037421] N77-26259
GAS HEATING
Experimental test of gas heat transfer system for hydroxide heat storage
[AI-ERDA-13176] N77-26655
GAS IONIZATION
Ionization instability of a non-self-sustaining discharge due to step ionization --- of gas mixtures
[BLL-CTO-1267-[9091.9F]] N77-26974
GAS LASERS
Nuclear pumped laser II
[NASA-CR-153292] N77-26479
Application and performance of rare gas oxide amplifiers
[UCRL-78483] N77-26484
Compact electron accelerator for pumping gas lasers
[UCRL-78537] N77-26487
Plasma chemistry processes in pulsed electric discharge lasers
[AD-A035036] N77-26497
A simple, high-power, low-cost nitrogen laser for dye laser pumping
[AD-A035580] N77-26506
Investigation of coupling of field emission cold cathode guns for gas lasers
[AD-A037734] N77-26510
Inelastic molecular collisions: Applications of theoretical methods to problems in relaxation phenomena and laser operation
[TID-27235] N77-26928
GAS MIXTURES
Ionization instability of a non-self-sustaining discharge due to step ionization --- of gas mixtures
[BLL-CTO-1267-[9091.9F]] N77-26974
GAS TEMPERATURE
Powder gas temperature variation in the barrel of an experimental cannon. First measurements
[ISL-R-109/76] N77-26329
GAS TURBINE ENGINES
A fluidic fuel and air bleed load control system for gas turbine engines
[AD-A035701] N77-26141
Development of directionally solidified eutectic nickel alloys for use in aircraft gas turbines at metal temperatures exceeding 1000 C
[AD-A037246] N77-26150
Evaluation of californium-252-based neutron radiography and photon scattering echniques for the inspection of hot iso-statically pressed components of T-700 aircraft engine
[AD-A036000] N77-26526
Energy Conversion Alternatives Study [ECAS], Phase 2. Volume 1: Summary and combined gas-stream turbine plant with an integrated low-BTU gasifier
[NASA-CR-134942-VOL-1] N77-26628
Braxton isotope power system. Phase 1: [Ground demonstration system] Configuration Control Document [CCD]
[TID-27252] N77-26644
Zirconia-foil compatibility test. Phase 1
[TE-4219-28-77] N77-26645
GAS TURBINES
The grain refinement of electroslag remelted Ni-base alloys --- Inconel 600
N77-26142
Plugging of cooling holes in film-cooled turbine vanes
[NASA-TM-X-73661] N77-26269
Air-supply units of combination internal combustion engines
[BLL-RTS-9748] N77-26511
The marine gas turbine: The UK provides a case study in technological development
[AD-A037686] N77-26535
GASEOUS DIFFUSION
Short- and long-term dispersion factors for calculating the environmental burden due to exhaust air streams
[ORNL-TR-4234] N77-26711

GASES
Application and performance of rare gas oxide amplifiers
[UCRL-78483] N77-26484

GASOLINE
Conversion of waste organic material to gasoline
[COO-2982-7] N77-26325

GAW-1 AIRFOIL
Analysis of the separated boundary layer flow on the surface and in the wake of blunt trailing edge airfoils
[NASA-CR-145202] N77-26075

GENERAL AVIATION AIRCRAFT
Exploratory investigation of the incipient spinning characteristics of a typical light general aviation airplane
[NASA-TM-X-73671] N77-26153

GEOCHEMISTRY
Geochemistry and hydrothermal alteration at selected Utah hot springs, volume 3
[PB-264415/1] N77-26606
GEODESY
Least-squares collocation as a gravitational inverse problem
[AD-A037008] N77-26749
GEODETIC SURVEYS
A technique for measuring optical line of sight
[AD-A037191] N77-26609
GEOIDS
The spectrum of the geoid from altimeter data
[NASA-TM-X-71337] N77-26567
GEOLOGICAL FAULTS
Resurvey of site stability quadrilaterals, Otay Mountain and Quincy, California --- San Andreas fault experiment
[NASA-CR-149155] N77-26728
GEOLOGICAL SURVEYS
The use of remote sensing in solving Florida's geological and coastal engineering problems
[NASA-CR-153286] N77-26584
Geophysical well logging for geohydrological purposes in unconsolidated formations
N77-26598
GEOLOGY
Comprehensive study of Leon-Queretaro area --- Mexico
[E77-10154] N77-26569
GEOMAGNETIC MICROPULSATIONS
Investigation of magnetic field phenomena in the ionosphere
[AD-A037541] N77-26731
GEOMAGNETISM
Investigation of magnetic field phenomena in the ionosphere
[AD-A037541] N77-26731
GEOMORPHOLOGY
Radiographic analysis of sedimentary structures and depositional histories in Apollo 15 cores
[NASA-CR-153265] N77-27052
GEOPHYSICAL OBSERVATORIES
Investigation of magnetic field phenomena in the ionosphere
[AD-A037541] N77-26731
GEORGIA
Experiment in information sharing: The LLL-Atlanta University Workshops
[UCID-17340] N77-27026
GEOS 3 SATELLITE
The spectrum of the geoid from altimeter data
[NASA-TM-X-71337] N77-26567
GEOTHERMAL RESOURCES
Geochemistry and hydrothermal alteration at selected Utah hot springs, volume 3
[PB-264415/1] N77-26606
University of Utah direct contact Geothermal Power Project report. A computer program for determining the thermodynamic properties of water
[UTEC-ME-76-171] N77-26642
GERMANIUM
Clinical high-purity germanium gamma-camera
[UCRL-78132] N77-26461
GERMANIUM COMPOUNDS
Low background Ge[Li] detector with anticoincidence NaI annulus [revised] --- for soil samples
[EGG-1183-2326-REV] N77-26463
GERMANY
Outline of the interferometer station
N77-26202
Reports from the German Meteorological Service. Volume 18, no. 141: The climate of Hamburg. Analysis for purposes of applied climatology with catalog of data --- period 1931-1970
[ISBN-3-88148-149-4] N77-26752
Meteorological data. Volume 142, no. 4: Aerological data, Berlin-Tempelhof, 1974
[QR-4] N77-26767
GLASS
Space processing of chalcogenide glass
[NASA-CR-150311] N77-26176
The determination of the molecular weight distribution of polymers by permeation chromatography on porous glass. 1: Dextrans up to a molecular weight of 600000
[BLL-M-24884-[5828.4F]] N77-26246
Localized damage in a viscous medium glass. Appendix A. Variations in localized impact damage caused by nominally similar impacts. Appendix B. Crack branching at Hertz cracks
[AD-A037303] N77-26311
Picosecond and nanosecond Nd: Glass high power laser amplifier system
[SAND-76-0432] N77-26482
Environmental considerations of selected energy conserving manufacturing process options. Volume 11: Glass industry
[PB-264277/5] N77-26688
Symposium on the structure of non-crystalline materials
[AD-A037948] N77-27012
GLASS ELECTRODES
Chemical modification of carbon electrodes
[AD-A036991] N77-26264

GLASS FIBERS
Research and development of the glass fiber sodium-sulfur battery
[AD-A037216] N77-26695
GLIDE PATHS
Control of a gliding parachute system in a non-uniform wind
[AD-A036076] N77-26102
GLOBAL POSITIONING SYSTEM
The transit system, 1975
[AD-A037398] N77-26196
GLUCOSIDES
The thermal decomposition of 2, 3, 4, 6-tetranitromethyl beta-d-glucopyranoside
[AD-A035584] N77-26257
GLYCOLYSIS
Influence of altered gaseous environments on lung metabolism
[AD-A037977] N77-26801
GOE SATELLITES
Solar-geophysical data number 389. Part 1: Prompt reports. Data for December 1976 - November 1976
[PB-264790/7] N77-27060
GOVERNMENT PROCUREMENT
Aircraft noise
[GPO-77-918] N77-26138
Maximizing flight fidelity integration of Naval Air Test Center capabilities into the procurement of major aviation training devices
[AD-A037687] N77-26173
GOVERNMENTS
Management assistance for Texas city governments. Volume 1: Appendices A-C
[PB-264866/5] N77-27045
GRAIN BOUNDARIES
The grain refinement of electroslag remelted Ni-base alloys --- Inconel 600
N77-26142
GRAPHITE
The application of a curved graphite crystal monochromator to X-ray diffractometry
[AD-A037952] N77-26474
Thermal radiative losses from graphite calorimeters used in pulsed electron beam experiments
[AD-A037754] N77-26475
GRAPHS (CHARTS)
Combustion research at Sandia Laboratories
[SAND-76-8511] N77-26253
GRAVITATIONAL FIELDS
Least-squares collocation as a gravitational inverse problem
[AD-A037008] N77-26749
GREAT BRITAIN
Observations on European low-temperature physics research: An annotated directory of low-temperature physics in British universities and some comments on the low temperature physics programs in Europe
[AD-A036959] N77-26339
GREAT LAKES (NORTH AMERICA)
Microwave properties of ice from The Great Lakes
[NASA-CR-135222] N77-26577
GROOVING
Effects of pavement grooving on friction, braking, and vehicle control
[PB-264665/1] N77-26560
GROUND EFFECT MACHINES
A nonlinear vertical-plane mathematical model for air cushion-supported vehicles
[AD-A037062] N77-26095
GROUND OPERATIONAL SUPPORT SYSTEM
An econometric analysis of enroute and terminal air traffic control
[AD-A036892] N77-26119
Braxton isotope power system. Phase 1: [Ground demonstration system] Configuration Control Document [CCD]
[TID-27252] N77-26644
GROUND STATIONS
Aeronautical systems technology needs. Test facilities and test equipment
[AD-A035252] N77-26171
The DFVLR radio interferometer --- satellite orbit determination
[BMFT-FB-W-76-25] N77-26201
Outline of the interferometer station
N77-26202
Local, regional and large scale integrated networks. Volume 2. Recent advances in ground packet radio systems
[AD-A035950] N77-26351
Results of UHF radiometric and direct ground measurements of soil moisture in 1975
[NASA-TT-F-17521] N77-26726
GROUND WATER
Geophysical well logging for geohydrological purposes in unconsolidated formations
N77-26598
Water resources data for California, 1975. Volume 1: Colorado River basin, southern great basin from Mexican border to Mono Lake Basin, and Pacific slope basins from Tijuana River to Santa Maria River
[PB-264474/8] N77-26602
Water resources data for California, 1975. Volume 2: Pacific slope basins from Arroyo Grande to Oregon State line except Central Valley
[PB-264475/5] N77-26603
GROWTH
Comprehensive aerosol growth model
[BNWL-SA-5931] N77-26706
Point defect interactions and growth of dislocation loops
[CONF-761027-7] N77-27000
GUIDANCE (MOTION)
Control of a gliding parachute system in a non-uniform wind
[AD-A036076] N77-26102
GULF OF MEXICO
Proceedings of a workshop on environmental oceanography of the Gulf of Mexico
[ORO-5017-1] N77-26787
GUN PROPELLANTS
Powder gas temperature variation in the barrel of an experimental cannon. First measurements
[ISL-R-109/76] N77-26329
GUNS (ORDNANCE)
Powder gas temperature variation in the barrel of an experimental cannon. First measurements
[ISL-R-109/76] N77-26329
GUSTS
Effect of gust modelling on the identification of the longitudinal motion derivatives of an aircraft --- HFB-320 aircraft
[DLR-FB-76-63] N77-26157

H

HALF CONES
Investigation of real-gas and viscous effects on the aerodynamic characteristics of a 40 deg half-cone with suggested correlations for the shuttle orbiter
[NASA-TN-D-8418] N77-26081
HALIDES
Vapor-pressure measurements by effusion methods
[PB-264295/7] N77-26290
HALOGEN COMPOUNDS
Inorganic halogen oxidizer research
[AD-A037421] N77-26259
HANDBOOKS
USAF propellant handbooks. Nitric acid/nitrogen tetroxide oxidizers, volume 2
[AD-A036741] N77-26331
Engineering design handbook: Analysis and design of automotive brake systems
[AD-A035143] N77-26519
Crysnet manual
[BNL-21714] N77-26863
HARDNESS
Synthesis of new superhard materials and their application to cutting tools
[AD-A035579] N77-26316
HARMONICS
Classical dynamics of triatomic system: Energized harmonic molecules
[CALT-767P4-49] N77-26929
HARPOON MISSILE
Evaluation of the Harpoon missile shock environment during ejection launch by aircraft launchers
[AD-A037067] N77-26186
HAZARDS
Explosive tests for establishing hazard classification for M1 SP propellant in automated single-base finishing operations
[AD-A037383] N77-26336
HCL LASERS
Electrically initiated HCl chemical laser and threshold excitation of XeF and KrF lasers
[AD-A037732] N77-26481
HEAT EXCHANGERS
A numerical model to evaluate the behavior of a regenerative heat exchanger at high temperature --- for magnetohydrodynamic generator
[TH-76-E-66] N77-26439
HEAT OF VAPORIZATION
Thermochemical analyses of the oxidative vaporization of metals and oxides by oxygen molecules and atoms
[NASA-TM-X-73682] N77-26270
HEAT PUMPS
Application of the ice-maker heat pump to an annual cycle energy system
[CONF-761107-13] N77-26659
HEAT STORAGE
Development and qualification of PCM thermal capacitors. Part 1: Development of a 30 Wh PCM thermal capacitor --- temperature control of electronic components
[BMFT-FB-W-76-26-VOL-1] N77-26436
Development and qualification of PCM thermal capacitors. Part 2: Development of PCM thermal capacitor platforms and PCM thermal capacitor radiators --- satellite temperature control
[BMFT-FB-W-76-27-VOL-2] N77-26437
Hydration-dehydration cycling of MgO-Mg[OH]2 for application to solar heat storage systems
[AI-ERDA-13178] N77-26654
Experimental test of gas heat transfer system for hydroxide heat storage
[AI-ERDA-13176] N77-26655
HEAT TRANSFER
Calculation of the heat transfer to boiling refrigerators
[BLL-RTS-9959] N77-26418
Heat transfer and pressure loss caused by coolant vaporization in a horizontal stream tube
[BLL-RTS-9956] N77-26419
An experimental investigation of the distribution function for the near free molecular parallel plate heat transfer problem
[UTIAS-210] N77-26426
Continuous surface-density Monte Carlo solution to the Dirichlet heat-transfer problem
[AD-A037899] N77-26429
Estimating heat-to-heat variation from a statistician's point of view
[CONF-761107-5] N77-26435
Thermal radiative losses from graphite calorimeters used in pulsed electron beam experiments
[AD-A037754] N77-26475
Experimental test of gas heat transfer system for hydroxide heat storage
[AI-ERDA-13176] N77-26655
HEATING
Solar heating and cooling technical data and systems analysis
[NASA-CR-150305] N77-26611
Application of the ice-maker heat pump to an annual cycle energy system
[CONF-761107-13] N77-26659
Comfort range thermal storage
[BNL-21591] N77-26661
HEAVY IONS
Theoretical research in physics of highly ionized atoms
[COO-2557-1] N77-26931
HEIGHT
Effect of multipath on the height-finding capabilities of a fixed-reflector radar system. Part 3: Effect of radome
[AD-A037957] N77-26356
HELICAL FLOW
Plasma heating in a toroidal system by a helical quadrupole RF field with omega omega omega sub Bi
[BLL-CTO-1292-[9091.9F]] N77-26965
HELICOPTER DESIGN
Design selection tests for TRAC retraction mechanism
[AD-A037307] N77-26129
Helicopter noise reduction design trade-off study
[AD-A038192/1] N77-26148
HELICOPTER ENGINES
Evaluation of californium-252-based neutron radiography and photon scattering echniques for the inspection of hot iso-statically pressed components of T-700 aircraft engine
[AD-A036000] N77-26526
HELICOPTER PERFORMANCE
Helicopter optimal descent and landing after power loss
[NASA-TM-X-73244] N77-26067
Airframe, wing, and tail aerodynamic characteristics of a 1/6-scale model of the rotor systems research aircraft with the rotors removed
[NASA-TN-D-8456] N77-26082
Research requirements for development of improved helicopter rotor efficiency
[NASA-CR-145117] N77-26121
HELICOPTER PROPELLER DRIVE
Research requirements for development of improved helicopter rotor efficiency
[NASA-CR-145117] N77-26121
HELICOPTERS
Pilotage navigation utilizing a night-vision system
[AD-A036774] N77-26118
A study using infra red thermography of clothing assemblies for use by personnel working beneath operating helicopters
[AD-A035966] N77-26805
Human factors considerations in new generation Army aircraft systems
[AD-A037992] N77-26806
HELIUM
Equilibrium and transport estimates for hydrogen and helium via Lennard-Jones fluid
[SAND-76-8710] N77-26434
Nuclear pumped laser II
[NASA-CR-153292] N77-26479
HERCULES NOVA
OSO-8 X-ray observations of AM Herculis
[NASA-TM-X-71313] N77-27050
HEWLETT-PACKARD COMPUTERS
Space surveillance software support. Volume 1, part 1, book 3: Computer program documentation
[AD-A033658] N77-26217

HFB-320 AIRCRAFT
Effect of gust modelling on the identification of the longitudinal motion derivatives of an aircraft --- HFB-320 aircraft
[DLR-FB-76-63] N77-26157
HIERARCHIES
RATS operating system
[UCRL-77378] N77-26819
HIGH ACCELERATION
Accelerator based atomic physics experiments: An overview
[CONF-761059-6] N77-26932
HIGH ENERGY ELECTRONS
Acoustical high speed holographic framing camera
[SAND-76-5886] N77-26468
HIGH ENERGY INTERACTIONS
Picosecond and nanosecond Nd: Glass high power laser amplifier system
[SAND-76-0432] N77-26482
Research on high-energy storage for laser amplifiers
[UCRL-13708] N77-26488
Radiolysis studies on reactive intermediates
[COO-2086-87] N77-26930
HIGH FREQUENCIES
Computational study of long-range high-frequency ionospheric ducting
[AD-A035502] N77-26378
HIGH PRESSURE
Measurement of an equation-of-state point for molybdenum at very high pressure
[LA-UR-76-2286] N77-26280
HIGH STRENGTH STEELS
Effect of lack of penetration on fatigue resistance of high-strength structural steel welds
[AD-A037047] N77-26302
Inhibition of hydrogen embrittlement in high strength steel
[AD-A037355] N77-26304
HIGH TEMPERATURE
Elevated temperature cyclic deformation of stainless-steel and interaction effects with other modes of deformation
[CONF-760819-16] N77-26284
High temperature properties and processes in ceramics: Thermomigration
[COO-2923-001] N77-26314
HIGH TEMPERATURE ENVIRONMENTS
Silicon solar cell development for concentrated-sunlight, high-temperature applications
[SAND-76-5311] N77-26647
HIGH TEMPERATURE GASES
Gasification and ignition of a condensed fuel by a hot stagnant gas
[AD-A037976] N77-26334
Isotope separation using metallic vapor lasers
[NASA-CASE-NPO-13550-1] N77-26477
HIGH VOLTAGES
Water as dielectric in high-voltage impulse devices
[UCRL-TRANS-11185] N77-26395
HIGHWAYS
Analytical and experimental assessment of highway impact on air quality
[PB-264590/1] N77-26724
HODOGRAPHS
An exact hodograph method for the design of supercritical airfoils
[MBB-UFE-1168[O]] N77-26124
HOLLOW
Electro-chemical measurements of mass transfer in semi-cylindrical hollows with laminar flow in a channel --- artificial membrane lung oxygenator development
[OUEL-1175/76] N77-26441
HOLLOW CATHODES
Experiments with a large sized hollow cathode discharge, part 3 --- plasma rotation
[TH-76-E-67] N77-26986
HOLOGRAPHIC INTERFEROMETRY
Acoustical high speed holographic framing camera
[SAND-76-5886] N77-26468
HOLOGRAPHY
Microsecond holographic interferometer for fracture studies
[UCRL-52161] N77-26462
HONEST JOHN ROCKET VEHICLE
The 03702A Honest John missile number 1547, round number 655 AML [3 December 1976]
[AD-A037937] N77-26780
The 03702A Honest John missile number 1548, round number 654 AML [15 November 1976]
[AD-A037936] N77-26781
HOT ELECTRONS
Hot electron production, anomalous absorption, and effect of intense electromagnetic fields on inverse bremsstrahlung absorption near the electron plasma frequency
[LA-UR-76-1951] N77-26982
HOVERING
Flap/lag/torsion dynamics of a uniform, cantilever rotor blade in hover
[NASA-TM-73248] N77-26068
Unsteady hovering wake parameters identified from dynamic model tests, part I
[NASA-CR-152022] N77-26077
HUBS
Construction of the three-dimensional numerical model of an automotive wheel hub
N77-26518
HUMAN BODY
Cesium-137 whole-body content in a normal New Mexico population
[LA-UR-76-2097] N77-26798
HUMAN FACTORS ENGINEERING
Delay of visual feedback in aircraft simulators
[AD-A037839] N77-26169
Human factors considerations in new generation Army aircraft systems
[AD-A037992] N77-26806
Human factors programs in Navy systems acquisition
[AD-A037775] N77-26807
Applications of human performance reliability evaluation concepts and demonstration guidelines
[AD-A037632] N77-26809
HUMAN PERFORMANCE
Program documentation for the T4 EUO Crew Station simulation programs
[AD-A037944] N77-26808
HYBRID CIRCUITS
Proceedings of the ECOM Hybrid Microcircuit Symposium, 1976
[AD-A035246] N77-26404
HYDRATION
Hydration-dehydration cycling of MgO-Mg[OH]2 for application to solar heat storage systems
[AI-ERDA-13178] N77-26654
HYDRAULIC EQUIPMENT
A test of the use of thermistor sensors for measuring small rates of water flow
[BLL-RTS-10421] N77-26455
HYDRAZINE ENGINES
Calculation of underexpanded jets issuing from supersonic nozzles --- noting position of jet boundary and application to hydrazine spacecraft propulsion engines
[REPT-75-4] N77-26438
HYDROCARBONS
Experimental results for hydrocarbon exhaust infrared model verification
[AD-A037252] N77-26238
Conversion of waste organic material to gasoline
[COO-2982-7] N77-26325
Hydrocarbons via photosynthesis
[LBL-5387] N77-26658
Measurements of background hydrocarbons in remote areas
[AD-A037361] N77-26725
HYDRODYNAMICS
Numerical integration of the governing equations for the domain of pure supersonic flows --- at pointed or blunt bodies
[ESA-TT-380] N77-26092
Experimental investigation of hydrodynamic coefficients of a small-waterplane area, twin-hull model
[AD-A035908] N77-26338
Numerical methods in hydrodynamic calculations
[UCRL-52112] N77-26430
Solution of transient problems in free surface hydrodynamics
[AD-A037717] N77-26452
Generation of internal waves by a moving region of pressures in a sea with a discontinuity layer
[AD-A036887] N77-26788
HYDROGEN
The effects of sintering parameters and particle size distribution on P/M steel forgings
[AD-A036983] N77-26303
Equilibrium and transport estimates for hydrogen and helium via Lennard-Jones fluid
[SAND-76-8710] N77-26434
Hydrogen storage via metal hydrides for utility and automotive energy storage applications
[BNL-21723] N77-26666
International Conference on Hydrogen and its Prospects
[AD-A036936] N77-26696
Conversion of tritiated hydrogen to water in the atmosphere
[BNWL-2113] N77-26737
HYDROGEN EMBRITTLEMENT
Inhibition of hydrogen embrittlement in high strength steel
[AD-A037355] N77-26304
HYDROGEN ENGINES
Modification techniques and performance characteristics of hydrogen-powered IC engines: State of the art, 1975
[ANCR-1302] N77-26516
Hydrogen storage via metal hydrides for utility and automotive energy storage applications
[BNL-21723] N77-26666
HYDROGEN OXYGEN ENGINES
Advanced thrust chamber technology
[NASA-CR-135221] N77-26221
HYDROGEN PEROXIDE
Absolute rate constant for the reaction of atomic chlorine with hydrogen peroxide vapor over the temperature range 265-400 K
[NASA-TM-X-71340] N77-26248
HYDROLOGY
Statistical information on activities in operational hydrology --- networks
[WMO-464] N77-26599
Discrimination of alternative hydrologic regression models: A user's manual
[PB-264285/8] N77-26607
HYDROXIDES
Experimental test of gas heat transfer system for hydroxide heat storage
[AI-ERDA-13176] N77-26655
HYPERBOLIC DIFFERENTIAL EQUATIONS
Accuracy property of certain hyperbolic difference schemes
[SAND-76-0389] N77-26838
HYPERBOLIC FUNCTIONS
An implicit, compact, finite difference method to solve hyperbolic equations
[VKI-TN-119] N77-26885

I

IBM COMPUTERS
Optimization guide for programs compiled under IBM FORTRAN H [OPT=2]
[NASA-TM-X-71307] N77-26827
ICE FORMATION
Simulation of cold cloud precipitation in a three-dimensional mesoscale model
[PB-265265] N77-26786
ICE REPORTING
Aerial ice reconnaissance and satellite ice information microfilm file
[AD-A037300] N77-26591
IDEAL FLUIDS
Lift, circulation and pressure distributions for a foil oscillating in pitching motion in a perfect fluid
[UFD-1] N77-26422
IDENTIFYING
Information, consistent estimation and dynamic system identification
[AD-A037972] N77-26913
IGNITION TEMPERATURE
Gasification and ignition of a condensed fuel by a hot stagnant gas
[AD-A037976] N77-26334
ILLIAC 4 COMPUTER
Optimizing path printed circuit board router --- for ILLIAC 4 computers
[UCRL-78564] N77-26408
IMAGE INTENSIFIERS
Improvement of the picture definition of a television signal of limited frequency bandwidth by linear measures
[BLL-RTS-10578] N77-26342
A sensitive infrared imaging up converter and spatial coherence of atmospheric propagation
[NASA-CR-149891] N77-27048
IMAGERY
Mesoscale determination of cloud-top height: Problems and solutions
[AD-A037954] N77-26776
Image processing research --- processing and reducing visual and two dimensional data
[AD-A035315] N77-26947
IMAGING TECHNIQUES
Digital reconstruction of a coded image obtained with a nonredundant pinhole array
[LA-UR-76-1789] N77-26464
Photocounting image tracking of fluctuating targets --- considering monopulse laser radar
[AD-A037774] N77-26509
Techniques of three-dimensional reconstruction
[BNL-20425] N77-26817
Automatic pattern recognition in a multi-sensor environment
[AD-A037968] N77-26880
Development study for a high accuracy star sensor. Volume 2: Detailed investigation of preferred concept --- noting CCD area imaging device
[ESA-CR[P]-923-VOL-2] N77-26946
Algorithms and hardware technology for image recognition
[AD-A035039] N77-26949
Experimental development of a FLIR sensor processor
[AD-A037142] N77-26952
Processing of FLIR data on DICIFER
[AD-A037136] N77-26956
IMP
Solar-geophysical data number 389. Part 2: Comprehensive reports. Data for July 1976 - June 1976 and miscellanea
[PB-264791/5] N77-27059
IMPACT DAMAGE
Localized damage in a viscous medium glass. Appendix A. Variations in localized impact damage caused by nominally similar impacts. Appendix B. Crack branching at Hertz cracks
[AD-A037303] N77-26311
IMPACT LOADS
Design curves for structural response due to impact loading
[AD-A037011] N77-26513

IMPACT PREDICTION
Presentation of missile flight information
[AD-A037756] N77-26193
IMPACT STRENGTH
Damage tolerance of thin skin sandwich panels
[AD-A037526] N77-26559
IMPLANTATION
Electron microscope study of defects in annealed boron implanted silicon
[AD-A037956] N77-27006
IMPLOSIONS
Dynamic stabilization of the Rayleigh-Taylor instability on laser-imploded shells
[AD-A035605] N77-26505
IMPULSE GENERATORS
Water as dielectric in high-voltage impulse devices
[UCRL-TRANS-11185] N77-26395
IMPURITIES
Impurity effects on the creep of polycrystalline magnesium and aluminum oxides at elevated temperatures
[COO-1591-31] N77-26996
INCOHERENT SCATTERING
Research in Aeronomy
[NASA-CR-153264] N77-26727
INCONEL [TRADEMARK]
The grain refinement of electroslag remelted Ni-base alloys --- Inconel 600
N77-26142
INDEPENDENT VARIABLES
Assessment of relative velocity as independent variable for space shuttle first stage guidance attitude command tables
[NASA-CR-151436] N77-26199
Calculation of performance parameters of an electroexplosive device using digital data techniques
[SAND-76-0373] N77-26323
INDEXES [DOCUMENTATION]
Observations on European low-temperature physics research: An annotated directory of low-temperature physics in British universities and some comments on the low temperature physics programs in Europe
[AD-A036959] N77-26339
A study of coverage overlap among fourteen major science and technology abstracting and indexing services
[PB-264559/6] N77-27027
Transportation-related data bases extracted from the national index of energy and environmental data bases. Part 1: Digest of detailed data base descriptions
[UCID-17316-PT-1] N77-27036
Transportation-related data bases extracted from the national index of energy and environmental data bases. Part 2: Detailed data base descriptions
[UCID-17316-PT-2] N77-27037
Solar-geophysical data number 389. Part 2: Comprehensive reports. Data for July 1976 - June 1976 and miscellanea
[PB-264791/5] N77-27059
Solar-geophysical data number 389. Part 1: Prompt reports. Data for December 1976 - November 1976
[PB-264790/7] N77-27060
INDIUM PHOSPHIDES
Synthesis of indium phosphide
[AD-A035507] N77-27002
INDUCTION MOTORS
Vehicle follower longitudinal control for automated guideway transit vehicles
[PB-264554/7] N77-27044
INDUSTRIAL ENERGY
Environmental considerations of selected energy conserving manufacturing process options. Volume 4: Petroleum refining industry report
[PB-264270/0] N77-26[illegible]
Environmental considerations of selected energy conserving manufacturing process options. Volume 5: Pulp and paper industry report
[PB-264271/8] N77-26682
Environmental considerations of selected energy conserving manufacturing process options. Volume 6: Olefins industry report
[PB-264272/6] N77-26683
Environmental considerations of selected energy conserving manufacturing process options. Volume 7: Ammonia industry report
[PB-264273/4] N77-26684
Environmental considerations of selected energy conserving manufacturing process options. Volume 8: Alumina/aluminum industry report
[PB-264274/2] N77-26685
Environmental considerations of selected energy conserving manufacturing process options. Volume 9: Textile industry report
[PB-264275/9] N77-26686
Environmental considerations of selected energy conserving manufacturing process options. Volume 10: Cement industry report
[PB-264276/7] N77-26687
Environmental considerations of selected energy conserving manufacturing process options. Volume 11: Glass industry
[PB-264277/5] N77-26688
Environmental considerations of selected energy conserving manufacturing process options. Volume 12: Chlor-alkali industry report
[PB-264278/3] N77-26689
Environmental considerations of selected energy conserving manufacturing process options. Volume 13: Phosphoric acid industry report
[PB-264279/1] N77-26690
Environmental considerations of selected energy conserving manufacturing process options. Volume 14: Primary copper industry report
[PB-264280/9] N77-26691
Environmental considerations of selected energy conserving manufacturing process options. Volume 15: Fertilizer industry report
[PB-264281/7] N77-26692
INDUSTRIAL PLANTS
Status of the steam-iron program
[CONF-761064-5] N77-26672
Techniques for the analysis of total energy and labor of industrial plants
[PB-264221/3] N77-26697
INDUSTRIAL WASTES
Potential use of power plant reject heat in commercial aquaculture
[ORNL/TM-5663] N77-26662
Measurement techniques for inorganic trace materials in control system streams
[PB-264345/0] N77-26714
INDUSTRIES
Environmental considerations of selected energy conserving manufacturing process options. Volume 2: Industry priority report
[PB-264268/4] N77-26679
Environmental considerations of selected energy conserving manufacturing process options. Volume 3: Iron and steel industry report
[PB-264269/2] N77-26680
INELASTIC COLLISIONS
Inelastic molecular collisions: Applications of theoretical methods to problems in relaxation phenomena and laser operation
[TID-27235] N77-26928
INERTIAL REFERENCE SYSTEMS
Flight test results of the Strapdown hexad Inertial Reference Unit [SIRU]. Volume 1: Flight test summary
[NASA-TM-73163] N77-26111
INFLATABLE STRUCTURES
Personal flotation devices research, phase 1
[AD-A037221] N77-26810
INFORMATION DISSEMINATION
Privacy and security issues in information systems
[AD-A037896] N77-27032
INFORMATION MANAGEMENT
Remote sensing program --- Cornell University program
[NASA-CR-153288] N77-26568
Distributed capability computing system
[UCRL-77800] N77-26869
INFORMATION RETRIEVAL
Monitor of distributed data systems [MODDS]. Part 1: Digest of functional specifications
[UCID-17314-PT-1] N77-26818
A computer storage and retrieval system for scientific data
[AD-A037738] N77-27031
INFORMATION SYSTEMS
Digital Avionics Information System [DAIS]: Current maintenance task analysis
[AD-A035683] N77-26132
Command Center Information System [CCIS] functions and capabilities
[AD-A037146] N77-26872
Information, consistent estimation and dynamic system identification
[AD-A037972] N77-26913
Experiment in information sharing: The LLL-Atlanta University Workshops
[UCID-17340] N77-27026
A study of coverage overlap among fourteen major science and technology abstracting and indexing services
[PB-264559/6] N77-27027
Privacy and security issues in information systems
[AD-A037896] N77-27032
INFORMATION THEORY
Space/time random processes and optimum array processing
[AD-A035593] N77-26379
Energy and chemical change --- information theory approach to branching ratios
[AD-A035695] N77-26927
INFRARED DETECTORS
A thermal imaging sensor evaluation facility
[AD-A037411] N77-26470
An algorithm to retrieve water vapor information from satellite measurements
[AD-A037405] N77-26747
Mesoscale determination of cloud-top height: Problems and solutions
[AD-A037954] N77-26776
Spectral characteristics of a flicker noise model
[MRL-R-680] N77-26881
Experimental development of a FLIR sensor processor
[AD-A037143] N77-26951
Experimental development of a FLIR sensor processor
[AD-A037142] N77-26952
Thermal imaging systems relative performance: 3-5 micrometers vs 8-12 micrometers
[AD-A037248] N77-26958
Infrared response of impurity doped silicon MOSFET's [IRFET's]
[AD-A036871] N77-26959
Surface study of semiconductor devices
[AD-A037502] N77-26990
Low-frequency noise in [HG, CD] TE detectors
[AD-A037185] N77-27005
INFRARED IMAGERY
A thermal imaging sensor evaluation facility
[AD-A037411] N77-26470
Algorithms and hardware technology for image recognition
[AD-A035039] N77-26949
Processing of FLIR data on DICIFER
[AD-A037136] N77-26956
Thermal imaging systems relative performance: 3-5 micrometers vs 8-12 micrometers
[AD-A037248] N77-26958
A sensitive infrared imaging up converter and spatial coherence of atmospheric propagation
[NASA-CR-149891] N77-27048
INFRARED LASERS
Development of spectrophones for CW and pulsed radiation sources
[AD-A035594] N77-26489
The 10.6 micron parametric frequency converter
[AD-A035040] N77-26495
Gregorian all-reflective optical system
[NASA-CASE-GSC-12058-1] N77-26942
INFRARED RADIATION
Experimental results for hydrocarbon exhaust infrared model verification
[AD-A037252] N77-26238
Laser atmospheric absorption studies
[AD-A036872] N77-26500
A comparison of measured 3.8 micron scattering from naturally occuring aerosols with that predicted by measured particle size statistics
[AD-A038032] N77-26742
Development of gallium arsenide for infrared windows
[AD-A037336] N77-26957
INFRARED SPECTRA
A computer program for the prediction of radiation from rocket exhaust plumes, volume 1
[AD-A037385] N77-26239
INFRARED SPECTROMETERS
Water vapor, nitric acid and ozone mixing ratio height profiles derived from spectral radiometric measurements
[AD-A037375] N77-26738
INORGANIC COATINGS
Research on coatings or surface treatment of metal powders
[AD-A036870] N77-26298
Boron trifluoride coatings for thermoplastic materials
[NASA-CASE-ARC-11057-1] N77-26308
Optical coatings 2-6 microns
[AD-A037257] N77-26961
INSOLATION
Test facility for solar-cell reference conditions
[NASA-CP-2010] N77-26618
INSTRUMENT COMPENSATION
Instrumentation calibration --- national and international standardization for laboratory equipment
[LBL-5506] N77-26466
INSTRUMENT ORIENTATION
Study on the feasibility of structural thermal canister for the instrument pointing sub-system of the Spacelab, volume 1
[ESA-CR[P]-922-VOL-1] N77-26219
Study on the feasibility of structural thermal canister for the instrument pointing sub-system of the Spacelab, volume 2
[ESA-CR[P]-922-VOL-2] N77-26220
INSTRUMENT TRANSMITTERS
On-orbit performance of the 12 GHz, 200 watt transmitter experiment package for CTS
[NASA-TM-X-73636] N77-26183
INSULATION
Comparative performance of structural layers in pavement systems. Volume 4: Analysis of insulating layers in pavement test sections
[AD-A038116/0] N77-26168
INTEGRAL EQUATIONS
Approximations for terms related to the kernel in thin-wire integral equations
[AD-A036729] N77-26416
Integral functionals, normal integrands and measurable selections
[AD-A037561] N77-26882
INTEGRATED CIRCUITS
CCD integrated circuit for transient recorders
[UCRL-78360] N77-26398
Development of an integrated power module inverter
[AD-A035815] N77-26403
Low temperature pressure-oxidation of silicon for integrated circuit technology
[AD-A035266] N77-26405
An integrated circuit floating point accumulator
[NASA-TN-D-8509] N77-27046

INTERFACES
The electronic structure of crystalline solids: Their surfaces and interfaces
[AD-A037797] N77-27008
INTERFEROMETERS
Microsecond holographic interferometer for fracture studies
[UCRL-52161] N77-26462
INTERFEROMETRY
Techniques for flaw detection in composite material structures
[AD-A036026] N77-26243
Spatial heterodyne interferometry of VY Canis Major's, alpha Orionis, alpha Scorpii, and R leonis at 11 microns
N77-27049
INTERIOR BALLISTICS
Comparison between two gas dynamic computation models of interior ballistics
[ISL-CO-219/76] N77-26328
Powder gas temperature variation in the barrel of an experimental cannon. First measurements
[ISL-R-109/76] N77-26329
Analysis of the friction behavior at high sliding velocities and pressure for gilding metal, annealed iron, copper and projectile steel
[AD-A035674] N77-26521
INTERNAL COMBUSTION ENGINES
Combustion research at Sandia Laboratories
[SAND-76-8511] N77-26253
Air-supply units of combination internal combustion engines
[BLL-RTS-9748] N77-26511
Modification techniques and performance characteristics of hydrogen-powered IC engines: State of the art, 1975
[ANCR-1302] N77-26516
INTERNAL WAVES
Generation of internal waves by a moving region of pressures in a sea with a discontinuity layer
[AD-A036887] N77-26788
INTERNATIONAL RELATIONS
A comparison of the USAF projected A-10 employment in Europe and the Luftwaffe Schlachtgeschwader experience on the eastern front in World War II
[AD-A036863] N77-26125
INTERPLANETARY MAGNETIC FIELDS
Solar-geophysical data number 389. Part 2: Comprehensive reports. Data for July 1976 - June 1976 and miscellanea
[PB-264791/5] N77-27059
Solar-geophysical data number 389. Part 1: Prompt reports. Data for December 1976 - November 1976
[PB-264790/7] N77-27060
INVENTORIES
Remote sensing of wetlands
[NASA-CR-153282] N77-26588
LACIE: A look to the future
[NASA-TM-74623] N77-26589
INVERTERS
Development of an integrated power module inverter
[AD-A035815] N77-26403
Trade-off investigations and detailed design of power inverters
[AD-A036027] N77-26407
INVESTMENTS
Analysis of flight equipment purchasing practices of representative air carriers
[NASA-CR-154619] N77-27021
INVISCID FLOW
The influence of boundary point procedures on accuracy and efficiency in flow field calculations
[DOC-77SDR016] N77-26424
Variational energy principle for compressible, baroclinic flow. 2: Free-energy form of Hamilton's principle
[NASA-TM-X-71343] N77-26425
ION BEAMS
Scatha satellite instrumentation report: Thermal plasma analyzer; rapid scan particle detector; electron beam system; positive ion beam system
[AD-A035506] N77-26185
Solar array maximum power tracking with closed-loop control of a 30-centimeter ion thruster
[NASA-TM-X-73643] N77-26222
A computer code for thrustor ion optics
N77-26228
Computed ion trajectories in thrustor beams
N77-26229
Introduction to and review of beam-foil spectroscopy
[AD-A036984] N77-26263
Dissociation of fast molecular-ion beams in thin foils
[CONF-761059-17] N77-26933
Oxide barriers on a GaAs by neutralized ion beam sputtering
[NASA-CR-152866] N77-27007
ION EMISSION
Review of past and present research studies on ion field emission
N77-26224
Mechanisms of ion emission from liquid cesium
N77-26226
Stability and thermal effects of field ion emitters
N77-26230
ION ENGINES
A computer code for thrustor ion optics
N77-26228
Computed ion trajectories in thrustor beams
N77-26229
Stability and thermal effects of field ion emitters
N77-26230
Field emission study
N77-26231
ION IMPLANTATION
Ion implantation in compound semiconductors
[AD-A037958] N77-27010
ION IRRADIATION
Ion plating: Concepts and applications
[SAND-76-5459] N77-26515
ION PROPULSION
Reliability estimating procedures for electric and thermochemical propulsion systems, volume I
[AD-A037745] N77-26234
ION SOURCES
Experiments with field emission ion sources
N77-26227
IONIC CRYSTALS
Lattice defects in ionic crystals: Report on the Berlin conference [1976]
[AD-A037950] N77-27016
IONIZATION CROSS SECTIONS
X-ray and gamma-ray line production by nonthermal ions
[NASA-TM-X-71335] N77-27061
IONOSPHERE
Research in Aeronomy
[NASA-CR-153264] N77-26727
IONOSPHERIC PROPAGATION
VLF/LF reflectivity of the polar ionosphere, 20 July - 20 September 1975
[AD-A036913] N77-26376
Computational study of long-range high-frequency ionospheric ducting
[AD-A035502] N77-26378
VLF/LF reflectivity of the polar ionosphere, 21 September 1975 - 3 January 1976
[AD-A037794] N77-26748
IONOSPHERIC SOUNDING
The 15002 Little John missile number 3139, round number 723 RG [11] January 1977
[AD-A037660] N77-26762
IONS
Determination of negative ion mass spectra of some explosives — ortho-, para-, di- and trinitrotoluene
[ISL-R-126/75] N77-26327
IRON
Analysis of the friction behavior at high sliding velocities and pressure for gilding metal, annealed iron, copper and projectile steel
[AD-A035674] N77-26521
Status of the steam-iron program
[CONF-761064-5] N77-26672
Environmental considerations of selected energy conserving manufacturing process options. Volume 3: Iron and steel industry report
[PB-264269/2] N77-26680
IRON ALLOYS
Corrosion, stress corrosion cracking, and electrochemistry of the iron and nickel base alloys in caustic environments
[COO-2421-03] N77-26277
IRON COMPOUNDS
The structure of a mixed-valence iron fluoride, Fe2F5.2H2O
[AD-A035714] N77-26266
IRRADIANCE
Indoor and outdoor measurements of performance of photovoltaic arrays
[NASA-CP-2010] N77-26626
IRRADIATION
Break-up dynamics of polymer beads under laser bombardment
[AD-A037718] N77-26309
ISOTOPE EFFECT
The manifestation of the kinetic isotope effect during the decomposition of organic macromolecules
[NASA-TT-F-17450] N77-26240
ISOTOPE SEPARATION
Isotope separation using metallic vapor lasers
[NASA-CASE-NPO-13550-1] N77-26477
ISOTOPES
Preliminary Failure Modes, Effects and Criticality Analysis [FMECA] of the Conceptual Brayton Isotope Power System [BIPS] flight system
[TID-27251] N77-26643
Supplement ERDA BIPS preliminary design review
[TID-27270] N77-26667
ITERATIVE SOLUTION
An implicit, compact, finite difference method to solve hyperbolic equations
[VKI-TN-119] N77-26885

J

J-79 ENGINE
Noise measurements of a Cullum detuner at the Woensdrecht airfield — test of J-79 engine
[IZF-1976-4] N77-26921
JACOBI MATRIX METHOD
Preliminary documentation of GEARBI: Solution of ODE systems with block-iterative treatment of the Jacobian
[UCID-30149] N77-26839
JET AIRCRAFT
Effect of winglets on a first-generation jet transport wing. 3: Pressure and spanwise load distributions for a semispan model at Mach 0.30
[NASA-TN-D-8478] N77-26083
JET AIRCRAFT NOISE
Aircraft noise
[GPO-77-918] N77-26138
Static and wind tunnel near-field/far-field jet noise measurements from model scale single-flow base line and suppressor nozzles. Summary report — conducted in the Boeing large anechoic test chamber and the NASA-Ames 40by 80-foot wind tunnel
[NASA-CR-2841] N77-26140
A comparison of two independent measurements and analysis of jet aircraft flyover noise
[NASA-TN-D-8379] N77-26920
JET BLAST EFFECTS
Application of the initial plume angle correlation to correct nozzle/aftbody pressure drag for hot exhaust gas effects
[AD-A037471] N77-26454
JET BOUNDARIES
Calculation of underexpanded jets issuing from supersonic nozzles — noting position of jet boundary and application to hydrazine spacecraft propulsion engines
[REPT-75-4] N77-26438
JET ENGINES
Integrated engine instrument system, volume I
[AD-A035565] N77-26143
Integrated engine instrument system, volume 2
[AD-A035566] N77-26144
JET EXHAUST
An experimental investigation using a normal jet plume simulator to determine jet plume effects on a long slender rocket configuration at Mach numbers from 0.2 to 1.5
[AD-A037735] N77-26093
Prediction of test cell visible emissions
[AD-A037694] N77-26146
JET MIXING FLOW
Study of non-isoenergetic turbulent jet mixing in a constant area duct
[AD-A033498] N77-26446
JET PROPULSION
Static, noise, and transition tests of a combined-surface-blowing V/STOL lift/propulsion system
[NASA-CR-151954] N77-26139
JP-5 JET FUEL
Analysis and testing of JP-5 fuel derived from coal
[AD-A036073] N77-26333

K

KALMAN FILTERS
Laser pointing and tracking using an adaptive extended Kalman filter
[AD-A035275] N77-26496
KENTUCKY
Analysis and testing of JP-5 fuel derived from coal
[AD-A036073] N77-26333
KERNEL FUNCTIONS
Approximations for terms related to the kernel in thin-wire integral equations
[AD-A036729] N77-26416
KINETIC ENERGY
Model analysis for penetration of spaced armor
[AD-A035460] N77-26520
KINETIC EQUATIONS
The manifestation of the kinetic isotope effect during the decomposition of organic macromolecules
[NASA-TT-F-17450] N77-26240
KINETICS
Factors affecting the open-circuit voltage and electrode kinetics of some iron/titanium redox flow cells
[NASA-TM-X-73669] N77-26612
KLYSTRONS
Development of a klystron for satellite operation in the 12 GHz frequency band
[BMFT-FB-W-76-24] N77-26358
KOREA
Evaluation of the Korean short-period array
[AD-A035587] N77-26746
KRYPTON
Electrically initiated HCl chemical laser and threshold excitation of XeF and KrF lasers
[AD-A037732] N77-26481

L

LABORATORIES
Assessment of the utility/utilization of the Air Force laboratories by the system program organizations
[AD-A037758] N77-27025
LABORATORY EQUIPMENT
Instrumentation maintenance — management methods
[LBL-5505] N77-26465
Comparison of wet chemical and instrumental methods for measuring airborne sulfate
[PB-264201/5] N77-26719
Laboratory equipment procurement
[LBL-5504] N77-27022
LAGRANGE MULTIPLIERS
Nonlinear optimization and generalized Lagrange multipliers
[AD-A037560] N77-26852
LAKE ICE
Microwave properties of ice from The Great Lakes
[NASA-CR-135222] N77-26577
LAMINAR FLOW
Electro-chemical measurements of mass transfer in semi-cylindrical hollows with laminar flow in a channel — artificial membrane lung oxygenator development
[OUEL-1175/76] N77-26441
LAMINATES
Laminated beams: Deflection and stress as a function of epoxy shear modulus
[PPPL-1287] N77-26313
LANCE MISSILE
The 12815C Lance missile number 2473, round number 289 RST [7 October 1976]
[AD-A037940] N77-26777
The 12811A Lance missile number 2200, round number 293 RCL [13 January 1977]
[AD-A037939] N77-26778
LAND MANAGEMENT
The use of remote sensing in solving Florida's geological and coastal engineering problems
[NASA-CR-153286] N77-26584
LAND USE
Land development in the Daly Basin
[E77-10155] N77-26570
Land development in the Daly Basin
[E77-10156] N77-26571
Development and application of operational techniques for the inventory and monitoring of resources and uses for the Texas coastal zone
[E77-10174] N77-26576
Remote sensing of effects of land use practices on water quality
[NASA-CR-150306] N77-26581
Regional land use and energy modeling
[BNL-21809] N77-26595
LANDING GEAR
Fatigue investigation of the C-2A nose landing gear
[AD-A037901] N77-26126
LANDING RADAR
Communications station evaluation report, Selfridge ANGB, Michigan, 9-18 November 1976
[AD-A037479] N77-26120
LANDSAT 1
LANDSAT-1 and LANDSAT-2 flight evaluation report, 23 July - 23 October 1976
[NASA-CR-152474] N77-26593
LANDSAT-1 and LANDSAT-2 flight evaluation report
[NASA-CR-152475] N77-26594
LANDSAT 2
LANDSAT-1 and LANDSAT-2 flight evaluation report, 23 July - 23 October 1976
[NASA-CR-152474] N77-26593
LANGUAGE PROGRAMMING
Structured planning and debugging. A linguistic theory of design
[AD-A036815] N77-26847
Overview of a linguistic theory of design
[AD-A036915] N77-26848
Network pattern processors
[AD-A037129] N77-26871
LAPLACE TRANSFORMATION
The application of the Routh approximation method to turbofan engine models
[NASA-TM-X-73623] N77-26137
LASER ANEMOMETERS
Experimental determination of the contrast of two interfering argon laser beams — laser anemometer development
[ISL-R-116/76] N77-26490
LASER APPLICATIONS
Investigation of possibilities for solar powered high energy lasers in space
[NASA-CR-153271] N77-26478
Analysis of laser fluorosensor systems for remote algae detection and quantification
[NASA-TN-D-8447] N77-26480
Investigation of beamed energy concepts for propulsion. Volume 1: Systems studies
[AD-A034995] N77-26491
Investigation of beamed energy concepts for propulsion. Volume 2: Laser/propellant coupling analyses
[AD-A035061] N77-26492
Photocounting image tracking of fluctuating targets — considering monopulse laser radar
[AD-A037774] N77-26509
LASER CAVITIES
Cavity dump-PTM Nd:laser
[AD-A037193] N77-26504
LASER DAMAGE
Optical hazards of weather service instrumentation, January 1977
[AD-A037617] N77-26507
Evaluation of a laser equipped rifle for the US Army Human Engineering Laboratory, Aberdeen Proving Ground, Maryland, 19 January 1977
[AD-A037615] N77-26508
LASER FUSION
Status of laser fusion
[UCRL-77056] N77-26938
Inertial confinement: A summary talk
[BLL-CTO-1300-[9091.9F]] N77-26970
LASER HEATING
Break-up dynamics of polymer beads under laser bombardment
[AD-A037718] N77-26309
LASER MATERIALS
Intrinsic and thermal stress modeling for thin-film multilayers
[AD-A035513] N77-26493
LASER MODE LOCKING
Crystal violet as a mode-locker of the rhodamine 6G dye laser
[AD-A037643] N77-26499
LASER OUTPUTS
Dynamic stabilization of the Rayleigh-Taylor instability on laser-imploded shells
[AD-A035605] N77-26505
LASER PLASMAS
Measurement of the widths of emission lines from laser produced plasmas
[UCRL-78446] N77-26983
LASER RANGE FINDERS
Application of the AN/GVS-5 laser rangefinder to cloud base height measurements
[AD-A038013] N77-26503
LASER RANGER/TRACKER
Laser pointing and tracking using an adaptive extended Kalman filter
[AD-A035275] N77-26496
LASERS
Nonequilibrium photochemical reactions induced by lasers
[MIT-2793-5] N77-26251
Four-D propagation code for high-energy laser beams: A user's manual
[UCID-17217] N77-26485
Laser atmospheric absorption studies
[AD-A036872] N77-26500
Atmospheric Cloud Physics Laboratory [ACPL] optical motion control study
[AD-A037250] N77-26741
Gregorian all-reflective optical system
[NASA-CASE-GSC-12058-1] N77-26942
Experimental study of the diffusion of the shape of a laser light pulse during its propagation in the sea
[AD-A036880] N77-26944
LATE STARS
Spatial heterodyne interferometry of VY Canis Major's, alpha Orionis, alpha Scorpii, and R leonis at 11 microns
N77-27049
LATERAL CONTROL
Flight test data for light aircraft spoiler roll control systems
[NASA-CR-153291] N77-26122
LATERAL STABILITY
Estimation at subsonic speeds of the longitudinal and lateral aerodynamic characteristics of wing-body combinations at angles up to 90 deg
[WRE-REPT-1672[WR/D]] N77-26080
LATTICE VIBRATIONS
Application of an electron beam to high density flows of N2, O2 and NO
[AD-A037197] N77-26935
Lattice defects in ionic crystals: Report on the Berlin conference [1976]
[AD-A037950] N77-27016
LATTICES [MATHEMATICS]
On three-dimensional reconstruction of optically thin solar emission sources
[NASA-TM-X-71341] N77-27056
LAUNCH DATES
The 12815C Lance missile number 2473, round number 289 RST [7 October 1976]
[AD-A037940] N77-26777
The 12811A Lance missile number 2200, round number 293 RCL [13 January 1977]
[AD-A037939] N77-26778
The 15002A Little John missile number 1936, round number 722 RG [7 December 1976]
[AD-A037938] N77-26779
The 03702A Honest John missile number 1547, round number 655 AML [3 December 1976]
[AD-A037937] N77-26780
The 03702A Honest John missile number 1548, round number 654 AML [15 November 1976]
[AD-A037936] N77-26781
LAUNCHERS
Summary of lightning activities by NASA for the Apollo Soyuz test project: Supplement no. 1 to Apollo Soyuz mission evaluation report
[NASA-TM-74755] N77-26729
LC CIRCUITS
Air-gapped structures as magnetic elements for use in power processing systems
[NASA-CR-153289] N77-26627
LEARNING
Microcomputer controlled, interactive testing terminal development
[AD-A035731] N77-26821
LEAST SQUARES METHOD
Least-squares collocation as a gravitational inverse problem
[AD-A037008] N77-26749
Application of robust/resistant techniques to crystal structure refinement
[BNWL-SA-5936] N77-26991
LENNARD-JONES GAS
Equilibrium and transport estimates for hydrogen and helium via Lennard-Jones fluid
[SAND-76-8710] N77-26434
LENSES
Assembly and testing of a 1.8 by 3.7 meter Fresnel lens solar concentrator
[NASA-CR-150300] N77-26610
LIBRARIES
Experiment in information sharing: The LLL-Atlanta University Workshops
[UCID-17340] N77-27026
Study of US Army libraries. Volume 2: Directory
[AD-A036002] N77-27028
Rand library evaluation survey
[AD-A037917] N77-27030
Study of US Army libraries, volume 1 — management methods
[AD-A036004] N77-27033
LIFT
Lift, circulation and pressure distributions for a foil oscillating in pitching motion in a perfect fluid
[UFD-1] N77-26422
LIFT DEVICES
Static, noise, and transition tests of a combined-surface-blowing V/STOL lift/propulsion system
[NASA-CR-151954] N77-26139
LIFTING BODIES
Wind tunnel tests of supersonic lifting bodies at Mach number 1.5 to 4.0
[AD-A037380] N77-26097
LIFTING ROTORS
Application of system identification to analytic rotor modeling from simulated and wind tunnel dynamic test data, part 2
[NASA-CR-152023] N77-26078
LIGHT [VISIBLE RADIATION]
The development of a parallel-channel spectrographic detector: Applications to Raman scattering
[AD-A037407] N77-26265
LIGHT AIRCRAFT
Flight test data for light aircraft spoiler roll control systems
[NASA-CR-153291] N77-26122
Influence of power on the spin of light planes
[NASA-TT-F-17447] N77-26152
LIGHT AMPLIFIERS
Non-linear optical amplification and absorption
[AD-A037103] N77-26954
LIGHT EMITTING DIODES
Research in materials science
[AD-A037760] N77-26413
LIGHT SCATTERING
Experimental study of the diffusion of the shape of a laser light pulse during its propagation in the sea
[AD-A036880] N77-26944
Research on crystal chemistry studies — scattering of light by magnetic spheres
[AD-A035478] N77-27001
LIGHT TRANSMISSION
Laser atmospheric absorption studies
[AD-A036872] N77-26500
DF laser propagation analysis
[AD-A037813] N77-26501
Low-cost optical data link design study
[AD-A035294] N77-26948
Determination of the light quantum survival parameter from the characteristics of light fields in the sea
[AD-A036879] N77-26953
Non-linear optical amplification and absorption
[AD-A037103] N77-26954
LIGHTNING
Effects of laboratory simulated precipitation static electricity and swept stroke lightning on aircraft windshield subsystems
[AD-A037196] N77-26127
LINE SPECTRA
X-ray and gamma-ray line production by nonthermal ions
[NASA-TM-X-71335] N77-27061

LINEAR SYSTEMS
Levinson- and Chandrasekhar-type equations for a general, discrete]time linear estimation problem
[AD-A037678] N77-26902
Establishment of linear sequences
[BLL-RTS-10323] N77-26903
FTANAL: Computer-aided analysis of continuous and sampled linear control systems --- based on transfer functions
N77-26911

LINEAR TRANSFORMATIONS
On three-dimensional reconstruction of optically thin solar emission sources
[NASA-TM-X-71341] N77-27056

LINGUISTICS
Structured planning and debugging. A linguistic theory of design
[AD-A036815] N77-26847
Overview of a linguistic theory of design
[AD-A036915] N77-26848
Applications of pattern theory to problems in computer science
[AD-A037128] N77-26875
Overview of a linguistic theory of design
[AD-A036977] N77-26876

LIPID METABOLISM
Influence of altered gaseous environments on lung metabolism
[AD-A037977] N77-26801

LIQUEFACTION
Analysis of nitrogen and air liquefaction systems
[OUEL-1163/76] N77-26337
Conversion of tritiated hydrogen to water in the atmosphere
[BNWL-2113] N77-26737

LIQUID AIR
Analysis of nitrogen and air liquefaction systems
[OUEL-1163/76] N77-26337

LIQUID CRYSTALS
Thermodynamics and statistical mechanics of liquid crystals and their solutions
[AD-A037105] N77-27003

LIQUID FLOW
Wall pressure fluctuations in a bubbly flow
[OUEL-1157/76] N77-26440

LIQUID METALS
Mechanisms of ion emission from liquid cesiim
N77-26226
Process for preparing liquid metal electrical contact device
[NASA-CASE-LEW-11978-1] N77-26385
Experimental two-phase liquid-metal magnetohydrodynamic generator program
[AD-A035245] N77-26988

LIQUID NITROGEN
Analysis of nitrogen and air liquefaction systems
[OUEL-1163/76] N77-26337

LIQUID OXIDIZERS
USAF propellant handbooks. Nitric acid/nitrogen tetroxide oxidizers, volume 2
[AD-A036741] N77-26331

LIQUID PROPELLANT ROCKET ENGINES
Advanced thrust chamber technology
[NASA-CR-135221] N77-26221

LIQUID ROCKET PROPELLANTS
Investigation of beamed energy concepts for propulsion. Volume 2: Laser/propellant coupling analyses
[AD-A035061] N77-26492

LITHIUM COMPOUNDS
Low background Ge[Li] detector with anticoincidence NaI annulus [revised] --- for soil samples
[EGG-1183-2326-REV] N77-26463

LITTLE JOHN ROCKET VEHICLE
The 15002A Little John missile number 1936, round number 722 RG [7 December 1976]
[AD-A037938] N77-26779

LOAD DISTRIBUTION [FORCES]
Effect of winglets on a first-generation jet transport wing. 3: Pressure and spanwise load distributions for a semispan model at Mach 0.30
[NASA-TN-D-8478] N77-26083

LOADS [FORCES]
Biaxial fatigue loading of notched composites
[NASA-CR-145198] N77-26241
Experimental studies of yield phenomena in biaxially loaded metals
[LA-UR-76-1413] N77-26279
The zig zag classifier: A windsifter with a novel classifying principle
[BLL-RTS-10357] N77-26420

LOGIC CIRCUITS
ESTEL: A computer program for simulation of logic circuits
N77-26908

LOGISTICS
Effects of weather on NATO/Warsaw pact air/ground operations
[AD-A037313] N77-26775

LOGISTICS MANAGEMENT
Project management of Army aircraft survivability equipment
[AD-A036785] N77-26128

LONGITUDINAL CONTROL
Effect of gust modelling on the identification of the longitudinal motion derivatives of an aircraft --- HFB-320 aircraft
[DLR-FB-76-63] N77-26157

LONGITUDINAL STABILITY
Estimation at subsonic speeds of the longitudinal and lateral aerodynamic characteristics of wing-body combinations at angles up to 90 deg
[WRE-REPT-1672[WR/D]] N77-26080
Effect of gust modelling on the identification of the longitudinal motion derivatives of an aircraft --- HFB-320 aircraft
[DLR-FB-76-63] N77-26157

LOW ALTITUDE
Low-altitude tracking development plan
[AD-A037593] N77-26218

LOW COST
A simple, high-power, low-cost nitrogen laser for dye laser pumping
[AD-A035580] N77-26506
Research and development of low cost processes for integrated solar arrays
[COO-2721-76-1] N77-26670

LOW FREQUENCIES
Measurement of long-term phase jitter in stuffing multiplex systems for PCM and data signals
[BLL-PO-TRANS-3407-[9022.81]]
N77-26343

LOW NOISE
An approach to low noise axial flow fan design, manufacture and testing
N77-26922

LOW PRESSURE
Wave motion in low-pressure-ratio rectangular and pyramidal shock tubes
[UTIAS-199] N77-26421

LOW SPEED STABILITY
Low speed wind tunnel tests of 1/10-scale model of a blended-arrow supersonic cruise aircraft
[NASA-TN-D-8410] N77-26069

LOW SPEED WIND TUNNELS
Low-speed wind tunnel tests of 1/9-scale model of a variable-sweep supersonic cruise aircraft --- conducted in the Langley full-scale wind tunnel
[NASA-TN-D-8380] N77-26070

LOW TEMPERATURE PHYSICS
Observations on European low-temperature physics research: An annotated directory of low-temperature physics in British universities and some comments on the low temperature physics programs in Europe
[AD-A036959] N77-26339

LOW TEMPERATURE TESTS
Low temperature heat capacity of scandium and scandium alloys
[IS-M-72] N77-26285
Low temperature pressure-oxidation of silicon for integrated circuit technology
[AD-A035266] N77-26405

LUMINESCENCE
Cathodoluminescence studies of the 1.4 eV bands in CdTe
[SAND-76-5472] N77-26995

LUNAR CORE
Radiographic analysis of sedimentary structures and depositional histories in Apollo 15 cores
[NASA-CR-153265] N77-27052

LUNAR MARIA
Characterization and distribution of lunar mare basalt types using remote sensing techniques
[NASA-CR-153267] N77-27051

LUNAR ROCKS
Characterization and distribution of lunar mare basalt types using remote sensing techniques
[NASA-CR-153267] N77-27051
Lunar sample studies --- breccias basalts, and anorthosites
[NASA-SP-418] N77-27053

LUNGS
Electro-chemical measurements of mass transfer in semi-cylindrical hollows with laminar flow in a channel --- artificial membrane lung oxygenator development
[OUEL-1175/76] N77-26441

M

MACH NUMBER
Wind tunnel tests of supersonic lifting bodies at Mach number 1.5 to 4.0
[AD-A037380] N77-26097

MACHINE TOOLS
Synthesis of new superhard materials and their application to cutting tools
[AD-A035579] N77-26316

MACHINE TRANSLATION
Threaded code for laboratory computers
[AD-A037190] N77-26824

MAGMA
Evolution of silicic magma chambers and their relationship to basaltic volcanism
[LA-UR-76-1708] N77-26734

MAGNESIUM OXIDES
Hydration-dehydration cycling of MgO-Mg[OH]2 for application to solar heat storage systems
[AI-ERDA-13178] N77-26654
Impurity effects on the creep of polycrystalline magnesium and aluminum oxides at elevated temperatures
[COO-1591-31] N77-26996

MAGNETIC CORES
Reluctance technique for approximating the performance of large air gap transformers
[SAND-76-0589] N77-26397

MAGNETIC DOMAINS
Magnetic stirling cycles: A new application for magnetic materials
[NASA-TM-X-73676] N77-26616

MAGNETIC FIELDS
Reluctance technique for approximating the performance of large air gap transformers
[SAND-76-0589] N77-26397
Function generator used for dynamic depolarization experiment --- creation of time dependent magnetic fields
[IRI-132-76-03] N77-26401
Analysis of magnetic suspension --- for energy storage by rotating cylinders
[SAND-76-0532] N77-26648
Magnetospheric magnetic field modeling
[AD-A037492] N77-26740
Bounce-averaged synchrotron loss in a dipole field
[AD-A037072] N77-26743
Strong fast-rising magnetic fields in experiments on heating a dense plasma in a rapid theta pinch
[BLL-CTO-1287-[9091.9F]] N77-26964

MAGNETIC FLUX
Use of state variables in the description of irradiation creep and deformation of metals
[COO-2172-14] N77-26275
Reluctance technique for approximating the performance of large air gap transformers
[SAND-76-0589] N77-26397

MAGNETIC INDUCTION
Air-gapped structures as magnetic elements for use in power processing systems
[NASA-CR-153289] N77-26627

MAGNETIC MATERIALS
Magnetic stirling cycles: A new application for magnetic materials
[NASA-TM-X-73676] N77-26616

MAGNETIC MIRRORS
Evaluation of the technical and economic feasibility of mirror fusion devices
[UCRL-13695] N77-26977

MAGNETIC PERMEABILITY
On the calculation of permeances and forces between doubly slotted structures --- reluctance stepping motors
[TH-76-E-65] N77-26400

MAGNETIC RECORDING
Study, tests, and evaluation for wideband high-density data acquisition [WHIDDA]
[AD-A037410] N77-26822

MAGNETIC SUSPENSION
Analysis of magnetic suspension --- for energy storage by rotating cylinders
[SAND-76-0532] N77-26648

MAGNETOHYDRODYNAMIC GENERATORS
A numerical model to evaluate the behavior of a regenerative heat exchanger at high temperature --- for magnetohydrodynamic generator
[TH-76-E-66] N77-26439
Applied research in the general area of charged particle chemistry related to coal-fired MHD
[PB-263873/2] N77-26987
Experimental two-phase liquid-metal magnetohydrodynamic generator program
[AD-A035245] N77-26988

MAGNETOHYDRODYNAMIC STABILITY
Dynamics of a non-cylindrical Z-pinch and the particle acceleration mechanism
[BLL-CTO-1289-[9091.9F]] N77-26966
Equilibrium and MHD stability of a plasma in stellarators with three-dimensional axes
[BLL-RISLEY-TR-1285-[9091.9F]]
N77-26967
Accelerated electron beam instability in Tokamaks
[BLL-CTO-1262-[9091.9F]] N77-26975
Lower hybrid parametric instabilities nonuniform pump waves and Tokamak applications
[PPPL-1308] N77-26976
Marginal stability analysis: A simpler approach to anomalous transport in plasmas
[AD-A036916] N77-26989

MAGNETOHYDRODYNAMICS
Dissipative, forced turbulence in two-dimensional magnetohydrodynamics
[NASA-CR-152862] N77-26980

MAGNETOMETERS
Investigation of magnetic field phenomena in the ionosphere
[AD-A037541] N77-26731
VLF/LF reflectivity of the polar ionosphere, 21 September 1975 - 3 January 1976
[AD-A037794] N77-26748

MAGNETOPAUSE
Penetration of solar wind plasma elements into the magnetosphere
[AERONOMICA-ACTA-A-166-1976] N77-27055
MAGNETOSPHERE
Correlated electric field and low-energy electron measurements in the low-altitude polar cusp
[NASA-CR-152863] N77-26739
Magnetospheric magnetic field modeling
[AD-A037492] N77-26740
MAINTAINABILITY
The effect of reliability and maintainability on the F-14A TF30P412A engine
[AD-A037985] N77-26525
MAINTENANCE
Instrumentation maintenance — management methods
[LBL-5505] N77-26465
A study using infra red thermography of clothing assemblies for use by personnel working beneath operating helicopters
[AD-A035966] N77-26805
MAN MACHINE SYSTEMS
Human factors considerations in new generation Army aircraft systems
[AD-A037992] N77-26806
Applications of human performance reliability evaluation concepts and demonstration guidelines
[AD-A037632] N77-26809
An assessment of reliability of dialogue annotation instructions
[AD-A037109] N77-26874
MANAGEMENT
Monitor of distributed data systems [MODDS]. Part 1: Digest of functional specifications
[UCID-17314-PT-1] N77-26818
MANAGEMENT INFORMATION SYSTEMS
Research on large file management information systems
[AD-A037161] N77-27024
MANAGEMENT METHODS
Instrumentation maintenance — management methods
[LBL-5505] N77-26465
Rand library evaluation survey
[AD-A037917] N77-27030
Study of US Army libraries, volume 1 — management methods
[AD-A036004] N77-27033
MANAGEMENT PLANNING
ACS. 1: An experimental management tool
[AD-A037311] N77-27023
Management assistance for Texas city governments. Volume 1: Appendices A-C
[PB-264866/5] N77-27045
MANEUVERABILITY
Aerodynamic configuration development of the highly maneuverable aircraft technology remotely piloted research vehicle
[NASA-CR-143841] N77-26076
MANIPULATORS
Remote manipulator system steering capability for SVDS
[NASA-CR-151438] N77-26804
MANNED SPACE FLIGHT
Updated dispersion analysis for the first Orbital Flight Test [OFT-1] mission
[NASA-CR-151434] N77-26174
MANPOWER
Aircraft industry capacity study
[AD-A037837] N77-26071
MANUALS
Adhesive bonded aerospace structures standardized repair handbook
[AD-A035601] N77-26072
MANUFACTURING
Manufacturing of field emitters
N77-26232
Environmental considerations of selected energy conserving manufacturing process options. Volume 4: Petroleum refining industry report
[PB-264270/0] N77-26681
Environmental considerations of selected energy conserving manufacturing process options. Volume 5: Pulp and paper industry report
[PB-264271/8] N77-26682
Environmental considerations of selected energy conserving manufacturing process options. Volume 6: Olefins industry report
[PB-264272/6] N77-26683
Environmental considerations of selected energy conserving manufacturing process options. Volume 7: Ammonia industry report
[PB-264273/4] N77-26684
Environmental considerations of selected energy conserving manufacturing process options. Volume 8: Alumina/aluminum industry report
[PB-264274/2] N77-26685
Environmental considerations of selected energy conserving manufacturing process options. Volume 9: Textile industry report
[PB-264275/9] N77-26686
Environmental considerations of selected energy conserving manufacturing process options. Volume 10: Cement industry report
[PB-264276/7] N77-26687
Environmental considerations of selected energy conserving manufacturing process options. Volume 11: Glass industry
[PB-264277/5] N77-26688
Environmental considerations of selected energy conserving manufacturing process options. Volume 12: Chlor-alkali industry report
[PB-264278/3] N77-26689
Environmental considerations of selected energy conserving manufacturing process options. Volume 13: Phosphoric acid industry report
[PB-264279/1] N77-26690
Environmental considerations of selected energy conserving manufacturing process options. Volume 14: Primary copper industry report
[PB-264280/9] N77-26691
Environmental considerations of selected energy conserving manufacturing process options. Volume 15: Fertilizer industry report
[PB-264281/7] N77-26692
MAPPING
Application of remote sensing techniques for the study and evaluation of natural resources in Peru
[E77-10171] N77-26573
Map projection equations
[AD-A037381] N77-26608
Geographic data base development
[AD-A037116] N77-26823
MARAGING STEELS
Failure analysis of pressure vessels with defects — maraging steel plate specimens
[OUEL-1168/76] N77-26550
MARINE METEOROLOGY
An examination of turbulent dissipation in the marine boundary layer
[AD-A035706] N77-26783
MARINE PROPULSION
The marine gas turbine: The UK provides a case study in technological development
[AD-A037686] N77-26535
MARINE RESOURCES
Application of LANDSAT-2 to the management of Delaware's marine and wetland resources
[E77-10173] N77-26575
MARS SURFACE
An interpretation of photometric parameters of bright desert regions of Mars and their dependence on wave length
[NASA-TN-D-8446] N77-27054
MASKS
Material studies for protective masks
[AD-A036736] N77-26310
MASS DISTRIBUTION
Survey and experimental testing of nongravimetric mass measurement devices
[NASA-CR-151427] N77-26456
MASS SPECTRA
Determination of negative ion mass spectra of some explosives — ortho-, para-, di- and trinitrotoluene
[ISL-R-126/75] N77-26327
MASS SPECTROSCOPY
A mass spectrometer investigation of the chemistry of plateau burning propellants
[AD-A035602] N77-26332
Direct-inlet mass spectrometer for real-time analysis of particulate contaminants in air
[BNWL-SA-5645] N77-26704
MASS TRANSFER
Electro-chemical measurements of mass transfer in semi-cylindrical hollows with laminar flow in a channel — artificial membrane lung oxygenator development
[OUEL-1175/76] N77-26441
MATERIALS
Temperature compensated piezoelectric materials
[AD-A037796] N77-27013
MATERIALS RECOVERY
Extractives as a renewable resource for industrial materials
[PB-264459/9] N77-26699
MATHEMATICAL LOGIC
Structured planning and debugging. A linguistic theory of design
[AD-A036815] N77-26847
Overview of a linguistic theory of design
[AD-A036915] N77-26848
Thinning of a point process over time
[AD-A037491] N77-26894
MATHEMATICAL MODELS
A nonlinear vertical-plane mathematical model for air cushion-supported vehicles
[AD-A037062] N77-26095
The coherent flame model for turbulent chemical reactions
[AD-A036768] N77-26261
Simulation of sub-span galloping of bundled conductors: A simplified model
[BLL-CE-TRANS-7067-[9022.09]] N77-26417
A numerical model to evaluate the behavior of a regenerative heat exchanger at high temperature — for magnetohydrodynamic generator
[TH-76-E-66] N77-26439
Model analysis for penetration of spaced armor
[AD-A035460] N77-26520
Transformation yielding reliability models based on independent random variables: A survey
[AD-A037969] N77-26527
Materials applications and mathematical properties of the rational polynomial creep equation
[ORNL-5202] N77-26545
Demonstration to characterize watershed runoff potential by microwave techniques
[NASA-CR-151426] N77-26579
Discrimination of alternative hydrologic regression models: A user's manual
[PB-264285/8] N77-26607
Atmospheric cloud physics thermal systems analysis
[NASA-CR-150312] N77-26753
Use of crop-weather models for assessing potential agricultural production
[REPT-891] N77-26756
The development, maintenance, and mathematical description of tracking behavior in man and the rhesus monkey
[AD-A038006] N77-26802
Spectral characteristics of a flicker noise model
[MRL-R-680] N77-26881
Cubic splines in clutter modeling
[AD-A036975] N77-26883
Statistical measures, probability densities, and mathematical models for stochastic measurements
[AD-A037483] N77-26900
Exponential Fourier densities on a Riemannian metric and optimal estimation for axial processes
[AD-A037505] N77-26914
MATRICES [MATHEMATICS]
Euler angles, quaternions, and transformation matrices for space shuttle analysis
[NASA-CR-151435] N77-26175
Levinson- and Chandrasekhar-type equations for a general, discrete-time linear estimation problem
[AD-A037678] N77-26902
MAXIMA
Maxima of partial samples in Gaussian sequences
[COO-2874-3] N77-26705
MEASUREMENT
The National Measurement System for Surface Properties
[PB-264258/5] N77-26340
MEASURING INSTRUMENTS
Project DAME: Tactical instrumented missile simulation testing
[AD-A035600] N77-26192
Survey and experimental testing of nongravimetric mass measurement devices
[NASA-CR-151427] N77-26456
Instrumentation maintenance — management methods
[LBL-5505] N77-26465
Meteorological data, series A monographs. Volume 1, no. 2: Accuracy of locating distant thunderstorm centers with Heinrich Hertz Institute's VLF atmospherics analyzer
N77-26768
Measuring the radioactivity of drinking water with the liquid counters M2H in combination with contamination meters IM 4457
[MBL-1976-10] N77-26934
MECHANICAL DEVICES
Design selection tests for TRAC retraction mechanism
[AD-A037307] N77-26129
MECHANICAL DRIVES
Treatment of the nonlinear vibration of a variable sweep aircraft wing with its drive using a simplified wing model
[MBB-UFE-1191[O]] N77-26156
Mechanical accuracy of the antenna rotary drive and its testing
N77-26204
Construction details of the interferometer rotary drive
N77-26205
Technical details of the control and drive systems — radio interferometer antennas
N77-26207
MECHANICAL OSCILLATORS
Survey and experimental testing of nongravimetric mass measurement devices
[NASA-CR-151427] N77-26456
MECHANICAL PROPERTIES
Effect of temperature on the mechanical properties of uranium
[SAND-76-6038] N77-26276
Casting warpage study
[BDX-613-1368] N77-26514
MEDICAL EQUIPMENT
A cervix-to-rectum measuring device in a radiation applicator for use in the treatment of cervical cancer
[NASA-CASE-GSC-12081-2] N77-26796

MEDICAL SERVICES
Aeromedical evaluation of UH-1 internal advanced personnel rescue hoists, Western Gear Corporation hoist models 42277R1 and 42305R1, Breeze Corporation hoist ECP-720 modification
[AD-A037621] N77-26130
MELTING
The grain refinement of electroslag remelted Ni-base alloys --- Inconel 600
N77-26142
MEMBRANE STRUCTURES
Water diffusion membranes 3 [pervaporation and heat rejection through composite membranes]
[NASA-CR-151967] N77-26423
MERCURY [METAL]
Low-frequency noise in [HG, CD] TE detectors
[AD-A037185] N77-27005
MERCURY ALLOYS
High pressure furnace growth of mercury cadmium telluride
[AD-A036918] N77-26294
MESSAGES
Communications processor system, volume 1, 2, and 3
[AD-A036873] N77-26370
Communications processor system, volume 8
[AD-A036874] N77-26371
Communications processor system
[AD-A037159] N77-26372
METAL COATINGS
Spectrophotometric determination of boron in cobalt and nickel coatings by use of carminic acid
[AD-A037344] N77-26293
Thin films
[BNL-21964] N77-26997
METAL CUTTING
Synthesis of new superhard materials and their application to cutting tools
[AD-A035579] N77-26316
METAL FATIGUE
Creep, cyclic creep, and fatigue fracture in a low alloy steel --- creep crack propagation
N77-26289
Nondestructive evaluation of metal fatigue
[AD-A037672] N77-26299
Data on the fatigue resistance of welded joints Al Mg5, volume 1
[REPT-76-4-VOL-1] N77-26554
Fatigue behavior of welded joints in Al Zn Mg1, Al Zn4 Mg1, and Al Mg Si [tables and diagrams]
[REPT-76-5-VOL-2] N77-26555
METAL HYDRIDES
Hydrogen storage via metal hydrides for utility and automotive energy storage applications
[BNL-21723] N77-26666
METAL OXIDE SEMICONDUCTORS
Infrared response of impurity doped silicon MOSFET's [IRFET's]
[AD-A036871] N77-26959
Oxide barriers on a GaAs by neutralized ion beam sputtering
[NASA-CR-152866] N77-27007
Planar CMOS/SOS array development
[AD-A037752] N77-27009
Investigation of defects and impurities in silicon-on-sapphire
[AD-A037753] N77-27011
METAL OXIDES
Thermochemical analyses of the oxidative vaporization of metals and oxides by oxygen molecules and atoms
[NASA-TM-X-73682] N77-26270
METAL PLATES
Irradiated dynamic fracture toughness of ASTM A533 grade B, class 1 steel plate and submerged arc weldment
[ORNL/SUB-3720-1] N77-26274
Failure analysis of pressure vessels with defects --- maraging steel plate specimens
[OUEL-1168/76] N77-26550
METAL POWDER
Research on coatings or surface treatment of metal powders
[AD-A036870] N77-26298
METAL SHEETS
Casting warpage study
[BDX-613-1368] N77-26514
METAL VAPORS
Isotope separation using metallic vapor lasers
[NASA-CASE-NPO-13550-1] N77-26477
METALS
Electrochemical theory of catalysis in metals
[UCRL-TRANS-11186] N77-26252
Experimental studies of yield phenomena in biaxially loaded metals
[LA-UR-76-1413] N77-26279
Vapor-pressure measurements by effusion methods
[PB-264295/7] N77-26290
Electronic structure of metals and semiconductors: Bulk, surface, and interface properties
[LBL-5493] N77-26992
Research on crystal chemistry studies --- scattering of light by magnetic spheres
[AD-A035478] N77-27001
METEOROLOGICAL CHARTS
Meteorological data, series B basic material. Volume 3, no. 4: Daily altitude charts of the 50 mb plane and monthly average charts for the year 1975, part 4
[QR-4-PT-4] N77-26769
Meteorological data, series B basic material. Volume 4, no. 3: Daily altitude charts of the 30 mb plane and monthly average charts for the year 1975, part 3
[QR-3-PT-3] N77-26770
Meteorological data, series B basic material. Volume 4, no. 4: Daily altitude charts of the 30 mb plane and monthly average charts for the year 1975, part 4
[QR-4-PT-4] N77-26771
The 12815C Lance missile number 2473, round number 289 RST [7 October 1976]
[AD-A037940] N77-26777
The 12811A Lance missile number 2200, round number 293 RCL [13 January 1977]
[AD-A037939] N77-26778
The 15002A Little John missile number 1936, round number 722 RG [7 December 1976]
[AD-A037938] N77-26779
The 03702A Honest John missile number 1547, round number 655 AML [3 December 1976]
[AD-A037937] N77-26780
The 03702A Honest John missile number 1548, round number 654 AML [15 November 1976]
[AD-A037936] N77-26781
METEOROLOGICAL PARAMETERS
The 14805 Lance Missile numbers 3208/3207, round numbers 285 APT/286 APT, 29 July 1976
[AD-A037661] N77-26761
The 15002 Little John missile number 3139, round number 723 RG [11] January 1977
[AD-A037660] N77-26762
The 12817C Lance missile number 2162 ECT, 15 October 1976
[AD-A037941] N77-26763
The 12817A Lance Missile number 2241, round 292 number ECL, 20 October 1976
[AD-A037935] N77-26764
Meteorological data. Volume 142, no. 4: Aerological data, Berlin-Tempelhof, 1974
[QR-4] N77-26767
The 12811A Lance missile number 2611, round number 287 ACT [30 September 1976]
[AD-A037934] N77-26782
METEOROLOGICAL RADAR
A depolarization and attenuation experiment using the CTS satellite --- meteorological radar
[NASA-CR-152535] N77-26347
METEOROLOGICAL SATELLITES
An algorithm to retrieve water vapor information from satellite measurements
[AD-A037405] N77-26747
Scientific lectures on meteorology --- conference proceedings, Geneva, May 1975
[WMO-435] N77-26754
The influence of space techniques on the development of meteorology
N77-26758
Towards a global operational system of meteorological satellites
N77-26759
METEOROLOGICAL SERVICES
Meteorological service in aid of agricultural production
N77-26757
METEOROLOGY
Scientific lectures on meteorology --- conference proceedings, Geneva, May 1975
[WMO-435] N77-26754
The influence of space techniques on the development of meteorology
N77-26758
World Weather Watch. Consolidated report on the voluntary assistance programme including projects approved for circulation in 1976
[WMO-465] N77-26774
METHANE
Investigation of the relationship between quasi-global and detailed kinetics mechanisms for the combustion of methane
[UCRL-78424] N77-26255
Fast production of methane by anaerobic digestion
[COO-2900-6] N77-26656
MEXICO
Comprehensive study of Leon-Queretaro area --- Mexico
[E77-10154] N77-26569
MICHIGAN
Remote sensing in Michigan for land resource management
[NASA-CR-153392] N77-26578
MICROBEAMS
Investigation of beamed energy concepts for propulsion. Volume 1: Systems studies
[AD-A034995] N77-26491
MICROELECTRONICS
Proceedings of the ECOM Hybrid Microcircuit Symposium, 1976
[AD-A035246] N77-26404
MICROFILMS
Computer Output Microforms Program And Concept Study [COMPACS] report
[AD-A035992] N77-27029
MICROORGANISMS
Selective enrichment and isolation of microorganisms on ethyl S-diisopropyl aminoethyl methylphosphonthioate [VX]
[CL-1975-27] N77-26793
Determination of antimicrobial susceptibilities of infected urines without isolation
[NASA-CASE-GSC-12046-1] N77-26797
MICROPHONES
The electret microphone: A new microphone for telephony
[BLL-PO-3384-[9022.81]] N77-26345
MICROPHOTOGRAPHS
Computer Output Microforms Program And Concept Study [COMPACS] report
[AD-A035992] N77-27029
MICROPROCESSORS
Manual for adjustment and handling of platforms for data collection via satellite [CDCP]
[NASA-TM-75020] N77-26182
Improvement of OTS attitude control [during stationkeeping] using a microprocessor
[N-30-472-0] N77-26190
Methodology and planning for a microprocessor-oriented real time controller design automation system
[UCID-17318] N77-26814
A microprocessor-based bit error performance monitor
[AD-A037612] N77-26825
Verification and feasibility study of a micro-computer based ballistics algorithm
[AD-A036062] N77-26846
A microcomputer-based reactor safety system
[OUEL-1159/76] N77-26941
MICROSTRUCTURE
Effects of microstructure on fatigue crack growth of high-strength aluminum alloys
[AD-A037156] N77-26300
Symposium on the structure of non-crystalline materials
[AD-A037948] N77-27012
MICROWAVE AMPLIFIERS
Advanced concepts of microwave generation and control in solids
[AD-A037945] N77-26383
X-band power FET development
[AD-A035642] N77-26410
MICROWAVE CIRCUITS
ESAMEC: Computer-aided analysis of microwave electronic circuits in the frequency domain
N77-26907
MICROWAVE RADIOMETERS
Microwave radiometer theory and measurements of sea ice characteristics
[REPT-S-89] N77-26600
MICROWAVES
GSFC short pulse radar, JONSWAP-75
[NASA-TN-D-8502] N77-26457
The 10.6 micron parametric frequency converter
[AD-A035040] N77-26495
Demonstration to characterize watershed runoff potential by microwave techniques
[NASA-CR-151426] N77-26579
MILITARY AIRCRAFT
Project management of Army aircraft survivability equipment
[AD-A036785] N77-26128
Integrated engine instrument system, volume 2
[AD-A035566] N77-26144
Human factors considerations in new generation Army aircraft systems
[AD-A037992] N77-26806
MILITARY SPACECRAFT
Scatha satellite instrumentation report: Thermal plasma analyzer; rapid scan particle detector; electron beam system; positive ion beam system
[AD-A035506] N77-26185
MILITARY TECHNOLOGY
Geographic data base development
[AD-A037116] N77-26823
MINERALS
Application of standard photogeologic techniques to LANDSAT imagery for mineral exploration in the basin and range province of Utah and Nevada
[E77-10170] N77-26572
MINICOMPUTERS
Threaded code for laboratory computers
[AD-A037190] N77-26824
LASL integrated computer network
[LA-UR-76-2321] N77-26865
MISSILE RANGES
Presentation of missile flight information
[AD-A037756] N77-26193
Low-altitude tracking development plan
[AD-A037593] N77-26218
The 14805 Lance Missile numbers 3208/3207, round numbers 285 APT/286 APT, 29 July 1976
[AD-A037661] N77-26761
MISSILE TRACKING
Presentation of missile flight information
[AD-A037756] N77-26193

Low-altitude tracking development plan
[AD-A037593] N77-26218
MISSILE TRAJECTORIES
Minimum energy control of a bilinear pursuit-evasion system
[AD-A037556] N77-26187
The 12817C Lance missile number 2162 ECT, 15 October 1976
[AD-A037941] N77-26763
The 12811A Lance missile number 2611, round number 287 ACT [30 September 1976]
[AD-A037934] N77-26782
MODELS
Will a rapidly expanding power-generating system be part of the energy problem or part of its solution
[UCRL-78500] N77-26651
Comprehensive aerosol growth model
[BNWL-SA-5931] N77-26706
Robustness of linear estimators to misspecification of trend
[COO-2874-4] N77-26709
MODES
Preliminary Failure Modes, Effects and Criticality Analysis [FMECA] of the Conceptual Brayton Isotope Power System [BIPS] flight system
[TID-27251] N77-26643
MODULATION
MODSIM: Its application to telecommunications --- simulation of modulated communication channels N77-26910
MOLDING MATERIALS
Casting titanium and zirconium in zircon sand molds
[PB-264253/6] N77-26292
MOLECULAR BEAMS
Dissociation of fast molecular-ion beams in thin foils
[CONF-761059-17] N77-26933
MOLECULAR COLLISIONS
Inelastic molecular collisions: Applications of theoretical methods to problems in relaxation phenomena and laser operation
[TID-27235] N77-26928
MOLECULAR EXCITATION
Ionization instability of a non-self-sustaining discharge due to step ionization --- of gas mixtures
[BLL-CTO-1267-[9091.9F]] N77-26974
MOLECULAR FLOW
An experimental investigation of the distribution function for the near free molecular parallel plate heat transfer problem
[UTIAS-210] N77-26426
MOLECULAR GASES
Application of an electron beam to high density flows of N2, O2 and NO
[AD-A037197] N77-26935
MOLECULAR IONS
Dissociation of fast molecular-ion beams in thin foils
[CONF-761059-17] N77-26933
MOLECULAR OSCILLATIONS
Pulsating combustion device miniaturization
[AD-A035707] N77-26147
MOLECULAR STRUCTURE
Conformational analysis of polymers
[AD-A037092] N77-26317
MOLECULAR WEIGHT
The determination of the molecular weight distribution of polymers by permeation chromatography on porous glass. 1: Dextrans up to a molecular weight of 600000
[BLL-M-24884-[5828.4F]] N77-26246
MOLECULES
The manifestation of the kinetic isotope effect during the decomposition of organic macromolecules
[NASA-TT-F-17450] N77-26240
Investigation of induced unimolecular decomposition for development of visible chemical lasers
[COO-2920-2] N77-26486
MOLYBDENUM
Measurement of an equation-of-state point for molybdenum at very high pressure
[LA-UR-76-2286] N77-26280
Radionuclidic impurities in 99Mo[99m] Tc generators, their measurements and importance
[BLL-RTS-10018] N77-26925
MONITORS
A technical description of the Automated Technical Control [ATEC] system AN/GYM-12-[V]
[AD-A037943] N77-26382
Monitor of distributed data systems [MODDS]. Part 1: Digest of functional specifications
[UCID-17314-PT-1] N77-26818
Alerters on network databases
[AD-A037438] N77-26860
Alerting in database systems: Concepts and techniques
[AD-A037437] N77-26861
An alerting system for a database management system
[AD-A037201] N77-26862
MONKEYS
The development, maintenance, and mathematical description of tracking behavior in man and the rhesus monkey
[AD-A038006] N77-26802
MONOCHROMATORS
The application of a curved graphite crystal monochromator to X-ray diffractometry
[AD-A037952] N77-26474
MONOPULSE ANTENNAS
DABS monopulse summary --- monopulse azimuth estimation
[AD-A038157/4] N77-26114
MONTE CARLO METHOD
Monte Carlo analysis of uncertainty propagation in a stratospheric model. 2: Uncertainties due to reaction rates
[NASA-TM-X-71339] N77-26349
Continuous surface-density Monte Carlo solution to the Dirichlet heat-transfer problem
[AD-A037899] N77-26429
A Monte-Carlo study of robust estimators of location
[AD-A035739] N77-26899
MOTION
Conformational analysis of polymers
[AD-A037092] N77-26317
MOTION STABILITY
Experimental investigation of hydrodynamic coefficients of a small-waterplane area, twin-hull model
[AD-A035908] N77-26338
The influence of support characteristics on the stability of an elastic system subjected to a circulatory force
[AD-A037929] N77-26918
MULTIPLEXING
Multiplex simulator design study
[AD-A037226] N77-26853
MULTISPECTRAL BAND SCANNERS
Analysis of significance within crop-spectra: A comparison study of different multispectral scanners
[NIWARS-PUBL-30] N77-26596
MULTISTAGE ROCKET VEHICLES
Assessment of relative velocity as independent variable for space shuttle first stage guidance attitude command tables
[NASA-CR-151436] N77-26199

N

NAPHTHALENE
Effect of naphthols on the thermal stability of fuels
[NASA-TT-F-17302] N77-26322
NASA PROGRAMS
NASA software specification and evaluation system: Software verification/validation techniques
[NASA-CR-150299] N77-26828
Technology transfer: Transportation
[NASA-CR-153272] N77-27034
Ames research center publications, 1975
[NASA-TM-X-73245] N77-27063
NASTRAN
Buckling analysis of ship plate-structures --- using NASTRAN program
[REPT-207-S] N77-26547
NATURAL GAS
A social and economic impact study of offshore petroleum and natural gas development in Alaska, phase 1
[PB-264705/5] N77-26677
A social and economic impact study of offshore petroleum and natural gas development in Alaska, phase 2
[PB-264706/3] N77-26693
NAVIER-STOKES EQUATION
Preliminary analysis and feasibility study on high speed turbulence generator
[UCID-17291] N77-26433
NAVIGATION AIDS
DABS monopulse summary --- monopulse azimuth estimation
[AD-A038157/4] N77-26114
Pilotage navigation utilizing a night-vision system
[AD-A036774] N77-26118
Verification and feasibility study of a micro-computer based ballistics algorithm
[AD-A036062] N77-26846
NAVIGATION SATELLITES
The transit system, 1975
[AD-A037398] N77-26196
NAVY
Maximizing flight fidelity integration of Naval Air Test Center capabilities into the procurement of major aviation training devices
[AD-A037687] N77-26173
Human factors programs in Navy systems acquisition
[AD-A037775] N77-26807
Low-temperature handwear with improved dexterity
[AD-A037535] N77-26811
NEAR INFRARED RADIATION
A method to obtain diffuse reflective measurements from 1.0 to 3.0 micrometers using a Cary 17I spectrophotometer
[AD-A035031] N77-26950
NEODYMIUM LASERS
Picosecond and nanosecond Nd: Glass high power laser amplifier system
[SAND-76-0432] N77-26482
Cavity dump-PTM Nd:laser
[AD-A037193] N77-26504
NETWORK ANALYSIS
Local, regional and large scale integrated networks: Volume 1. Large networks for defense communications: Strategies, performance measures and cost trends
[AD-A035949] N77-26350
Local, regional and large scale integrated networks. Volume 2. Recent advances in ground packet radio systems
[AD-A035950] N77-26351
Local, regional and large scale integrated networks. Volume 3. Recent advances in large scale integrated networks
[AD-A035951] N77-26352
Local, regional and large scale integrated networks; Volume 4. Local and regional communication networks - technologies and architectures
[AD-A035952] N77-26353
Computer-aided analysis of electronic filters
[ESA-TM-171] N77-26399
Computional techniques for the reduction of nonlinear effects using passive compensating networks
[AD-A035855] N77-26406
Computer-aided analysis of circuits and systems --- workshop held 24 Jan. 1977
[ESA-SP-123] N77-26904
Overall view of computer-aided analysis at ESTEC N77-26905
IMAG-3: Non-linear circuit analysis --- program for electronic circuit simulation at component level N77-26906
ESAMEC: Computer-aided analysis of microwave electronic circuits in the frequency domain N77-26907
NETWORKS
Feasibility study of networks
[COO-2487-4] N77-26864
LASL integrated computer network
[LA-UR-76-2321] N77-26865
NEUROLOGY
Studies in neuroendocrine pharmacology
[NASA-CR-153278] N77-26795
NEUTRAL PARTICLES
The kinetics of neutrals produced during the injection of an atom beam into the plasma
[BLL-CTO-1284-[9091.9F]] N77-26972
NEUTRINOS
Report on the Brookhaven solar neutrino experiment
[BNL-21837] N77-27058
NEUTRON IRRADIATION
Interface states in Schottky barrier diodes
[AD-A035720] N77-26412
NEUTRON SOURCES
The shielding of a 14 MeV neutron generator
[MRL-TN-387] N77-26937
NEVADA
Application of standard photogeologic techniques to LANDSAT imagery for mineral exploration in the basin and range province of Utah and Nevada
[E77-10170] N77-26572
NEW ENGLAND [US]
Energy situation in New England
[BNL-50580] N77-26650
NEW MEXICO
The 14805 Lance Missile numbers 3208/3207, round numbers 285 APT/286 APT, 29 July 1976
[AD-A037661] N77-26761
Cesium-137 whole-body content in a normal New Mexico population
[LA-UR-76-2097] N77-26798
NEW YORK
An analysis of the feasibility of windmills for power generation in New York State
[RPI-TA-17] N77-26631
NICKEL
Spectrophotometric determination of boron in cobalt and nickel coatings by use of carminic acid
[AD-A037344] N77-26293
Point defect interactions and growth of dislocation loops
[CONF-761027-7] N77-27000
NICKEL ALLOYS
Development of directionally solidified eutectic nickel-alloys for use in aircraft gas turbines at metal temperatures exceeding 1000 C
[AD-A037246] N77-26150
Corrosion, stress corrosion cracking, and electrochemistry of the iron and nickel base alloys in caustic environments
[COO-2421-03] N77-26277
NICKEL PLATE
Electroless-nickel plating of a large turbine rotor for the geothermal program
[UCID-17253] N77-26286
NICKEL STEELS
Intergranular stress corrosion cracking of sensitized chrome-nickel steels in boiling water
[ORNL-TR-4272] N77-26287

NIGHT VISION
Pilotage navigation utilizing a night-vision system
[AD-A036774] N77-26118
NIOBIUM STANNIDES
Research and development efforts relative to superconducting materials
[CONS/2551-1] N77-26998
Comparative cost study of the processes for producing niobium-tin {Nb3 Sn} superconducting tapes for their application to power transmission lines
[ERDA-76-160] N77-26999
NITRATES
The thermal decomposition of 2, 3, 4, 6-tetranitromethyl beta-d-glucopyranoside
[AD-A035584] N77-26257
NITRIC ACID
Water vapor, nitric acid and ozone mixing ratio height profiles derived from spectral radiometric measurements
[AD-A037375] N77-26738
NITRO COMPOUNDS
Fluorodinitro silicon compounds. Part 1: Organosilicon and silicate esters of 2,2,2-fluorodinitroethanol. Part 2: Nonhydrolyzable silanes
[AD-A037464] N77-26335
NITROGEN OXIDES
Technical and economic evaluation of NOx control for coal-fired cyclone furnaces
[PB-264642/0] N77-26723
NOAA 4 SATELLITE
Meteorological data, series B basic material. Volume 5, no. 4: European climatology 1975. Weather satellite data received in the Berlin area, part 4 --- ESSA 8 and NOAA 4 daily data
[QR-4-PT-4] N77-26773
NOISE INTENSITY
An investigation of basic noise properties of field emission
[AD-A037094] N77-26390
NOISE MEASUREMENT
Static and wind tunnel near-field/far-field jet noise measurements from model scale single-flow base line and suppressor nozzles. Summary report --- conducted in the Boeing large anechoic test chamber and the NASA-Ames 40by 80-foot wind tunnel
[NASA-CR-2841] N77-26140
A comparison of two independent measurements and analysis of jet aircraft flyover noise
[NASA-TN-D-8379] N77-26920
Noise measurements of a Cullum detuner at the Woensdrecht airfield --- test of J-79 engine
[IZF-1976-4] N77-26921
Noise emission measurements for regulatory purposes
[PB-264667/7] N77-26924
NOISE POLLUTION
Judgements of relative noisiness of a supersonic transport and several commercial-service aircraft
[NASA-TN-D-8434] N77-26702
NOISE REDUCTION
Helicopter noise reduction design trade-off study
[AD-A038192/1] N77-26148
Noise emission measurements for regulatory purposes
[PB-264667/7] N77-26924
NOISE TOLERANCE
Aircraft noise
[GPO-77-918] N77-26138
NONDESTRUCTIVE TESTS
Nondestructive evaluation of metal fatigue
[AD-A037672] N77-26299
Computer controlled X-ray stress analysis for inspection of manufactured components
[AD-A037350] N77-26529
NONFLAMMABLE MATERIALS
Non-reflective, wettable, fibrous fabric assemblies for firefighters' clothing
[AD-A038028] N77-26320
NONLINEAR PROGRAMMING
Solution of transient optimization problems by using an algorithm based on nonlinear programming
[NASA-TM-X-73618] N77-26829
Nonlinear optimization and generalized Lagrange multipliers
[AD-A037560] N77-26852
NONLINEAR SYSTEMS
Model structure determination and test input selection for identification of nonlinear regimes
[AD-A037831] N77-26131
A comparison of the effects of specimen thickness and subcritical crack growth on several nonlinear fracture toughness parameters
[AD-A037470] N77-26296
Solution of transient problems in free surface hydrodynamics
[AD-A037717] N77-26452
Application of hybrid finite elements to structure mechanics problems
[AD-A038016] N77-26563
Optimal control of a stochastic bilinear system
[OUEL-1156/76] N77-26873
IMAG-3: Non-linear circuit analysis --- program for electronic circuit simulation at component level
N77-26906
NONLINEARITY
Influence of temper condition on the nonlinear stress-strain behavior of boron-aluminum
[NASA-TM-X-74753] N77-26271
NORMAL DENSITY FUNCTIONS
Maxima of partial samples in Gaussian sequences
[COO-2874-3] N77-26705
Tables of required sample size for pairwise comparisons.
[AD-A035603] N77-26898
NORTHERN HEMISPHERE
Meteorological data, series B basic material. Volume 3, no. 4: Daily altitude charts of the 50 mb plane and monthly average charts for the year 1975, part 4
[QR-4-PT-4] N77-26769
Meteorological data, series B basic material. Volume 4, no. 3: Daily altitude charts of the 30 mb plane and monthly average charts for the year 1975, part 3
[QR-3-PT-3] N77-26770
Meteorological data, series B basic material. Volume 4, no. 4: Daily altitude charts of the 30 mb plane and monthly average charts for the year 1975, part 4
[QR-4-PT-4] N77-26771
NOSE CONES
Stability and transition in boundary layers on reentry vehicle nosetips
[AD-A035712] N77-26449
NOSE WHEELS
Fatigue investigation of the C-2A nose landing gear
[AD-A037901] N77-26126
NOZZLE DESIGN
A computer program for the design of plane and axisymmetric supersonic wind tunnel nozzles
[ESA-TT-367] N77-26170
NOZZLE EFFICIENCY
Static and wind tunnel near-field/far-field jet noise measurements from model scale single-flow base line and suppressor nozzles. Summary report --- conducted in the Boeing large anechoic test chamber and the NASA-Ames 40by 80-foot wind tunnel
[NASA-CR-2841] N77-26140
NOZZLE FLOW
Comparison between possible variants of a program using an unsteady numerical scheme for calculation of the flow in a one-dimensional nozzle
N77-26443
Application of the initial plume angle correlation to correct nozzle/aftbody pressure drag for hot exhaust gas effects
[AD-A037471] N77-26454
NUCLEAR EXPLOSION EFFECT
Application of light-initiated explosive for simulating X-ray blowoff impulse effects on a full scale reentry vehicle
[SAND-76-9019] N77-26189
Stresses produced in a long cylinder by a nuclear thermal environment
[AD-A037426] N77-26539
NUCLEAR EXPLOSIONS
Stress-gage system for the megabar [100GPa] range
[AD-A035583] N77-26459
NUCLEAR FUSION
Evaluation of the technical and economic feasibility of mirror fusion devices
[UCRL-13695] N77-26977
NUCLEAR PUMPING
Nuclear pumped laser II
[NASA-CR-153292] N77-26479
NUCLEAR RADIATION
Clinical high-purity germanium gamma-camera
[UCRL-78132] N77-26461
NUCLEAR REACTIONS
Neutron transmutation doped silicon solar cells
[CONF-761130-2] N77-26671
NUCLEAR REACTORS
Internalizing social costs in power plant siting: Some examples for coal and nuclear plants in the United States
[CONF-761103-16] N77-26816
NUCLEAR RESEARCH AND TEST REACTORS
The controlled thermonuclear fusion research programme in the USSR for 1976 - 1977
[BLL-CTO-1296-[9091.9F]] N77-26969
NUMERICAL ANALYSIS
The numerical computations of supersonic flow past blunt bodies
[AD-A037665] N77-26105
Numerical simulation of natural convection in closed containers using a fully implicit method
[DP-MS-75-127] N77-26431
Numerical solution of the spray equation
[UCID-17361] N77-26517
Numerical analysis of the dynamic response of elasto-plastic shells
[AD-A035965] N77-26537
KWIC index for numerical algebra, supplement 1
[ORNL/CSD-18-[SUPPL-1]] N77-26884
Asymptotic representation of Stirling numbers of the second kind
[AD-A035713] N77-26896
NUMERICAL INTEGRATION
Numerical integration of the governing equations for the domain of pure supersonic flows --- at pointed or blunt bodies
[ESA-TT-380] N77-26092
NYLON {TRADEMARK}
Documentation of the feasibility research on a destructible parachute
[SAND-76-0111] N77-26087

O

OCEAN SURFACE
GSFC short pulse radar, JONSWAP-75
[NASA-TN-D-8502] N77-26457
OCEANOGRAPHY
Proceedings of a workshop on environmental oceanography of the Gulf of Mexico
[ORO-5017-1] N77-26787
OCEANS
The spectrum of the geoid from altimeter data
[NASA-TM-X-71337] N77-26567
Theoretical study of the evolution of mixed phase cumulus clouds
[BNWL-SA-5880] N77-26766
OCULOMETERS
Description and flight tests of an oculometer
[NASA-TN-D-8419] N77-26154
OIL SLICKS
Performance of coherent-on-receive synthetic aperture side looking airborne radar --- for oil slick detection
[AD-A035032] N77-26366
ONE DIMENSIONAL FLOW
Comparison between possible variants of a program using an unsteady numerical scheme for calculation of the flow in a one-dimensional nozzle
N77-26443
OPERATIONS RESEARCH
Monitor of distributed data systems [MODDS]. Part 1: Digest of functional specifications
[UCID-17314-PT-1] N77-26818
Study of US Army libraries, volume 1 --- management methods
[AD-A036004] N77-27033
OPERATOR PERFORMANCE
Applications of human performance reliability evaluation concepts and demonstration guidelines
[AD-A037632] N77-26809
OPERATORS {PERSONNEL}
Controlling transactions between distributed computer resources
[UCRL-78282-REV-1] N77-26870
OPTICAL COMMUNICATION
Gregorian all-reflective optical system
[NASA-CASE-GSC-12058-1] N77-26942
Low-cost optical data link design study
[AD-A035294] N77-26948
Theoretical studies of fiber optical waveguides and integrated optical circuits
[AD-A035643] N77-26955
OPTICAL DATA PROCESSING
Development of an optical disc recorder --- using tellurium film
[AD-A037832] N77-26473
Image processing research --- processing and reducing visual and two dimensional data
[AD-A035315] N77-26947
OPTICAL HETERODYNING
Gregorian all-reflective optical system
[NASA-CASE-GSC-12058-1] N77-26942
OPTICAL MEASUREMENT
A technique for measuring optical line of sight
[AD-A037191] N77-26609
OPTICAL PROPERTIES
Optical materials characterization --- refractive indices of chemical vapor deposited ZnS
[AD-A037525] N77-26960
Optical properties of layer compounds Ga s sub x Se sub 1-x
[LBL-5464] N77-26994
OPTICAL PUMPING
Compact electron accelerator for pumping gas lasers
[UCRL-78537] N77-26487
Polychromatic, flashlamp-pumped dye lasers
[AD-A037393] N77-26498
Cavity dump-PTM Nd:laser
[AD-A037193] N77-26504
OPTICAL RADAR
Photocounting image tracking of fluctuating targets --- considering monopulse laser radar
[AD-A037774] N77-26509
Multidisciplinary lidar system in Spacelab for application to atmospheric physics and remote sensing --- aerosols and trace gases
[BMFT-FB-W-76-23] N77-26597
A dual electro-optical light image receiver and recorder
[AD-A037955] N77-26745
OPTICAL REFLECTION
Gregorian all-reflective optical system
[NASA-CASE-GSC-12058-1] N77-26942

A method to obtain diffuse reflective measurements from 1.0 to 3.0 micrometers using a Cary 17I spectrophotometer
[AD-A035031] N77-26950
OPTICAL RESONANCE
Atmospheric Cloud Physics Laboratory [ACPL] optical motion control study
[AD-A037250] N77-26741
OPTICAL TRACKING
Photocounting image tracking of fluctuating targets — considering monopulse laser radar
[AD-A037774] N77-26509
OPTICAL WAVEGUIDES
Theoretical studies of fiber optical waveguides and integrated optical circuits
[AD-A035643] N77-26955
OPTICS
A computer code for thrustor ion optics
N77-26228
OPTIMAL CONTROL
Helicopter optimal descent and landing after power loss
[NASA-TM-X-73244] N77-26067
Optimal control of a stochastic bilinear system
[OUEL-1156/76] N77-26873
A computerized traffic control algorithm to determine optimal traffic signal settings
[NASA-TM-X-73607] N77-27035
OPTIMIZATION
An econometric analysis of enroute and terminal air traffic control
[AD-A036892] N77-26119
Optimization of the characteristics of structural reinforced plastics. Part I: General theory
[CRIF-PL-10] N77-26315
Optimization guide for programs compiled under IBM FORTRAN H [OPT=2]
[NASA-TM-X-71307] N77-26827
Solution of transient optimization problems by using an algorithm based on nonlinear programming
[NASA-TM-X-73618] N77-26829
Nonlinear optimization and generalized Lagrange multipliers
[AD-A037560] N77-26852
Strategies for the minimization of an unconstrained nonconvex function
[AD-A037820] N77-26890
Application of robust/resistant techniques to crystal structure refinement
[BNWL-SA-5936] N77-26991
ORBIT CALCULATION
The DFVLR radio interferometer — satellite orbit determination
[BMFT-FB-W-76-25] N77-26201
Systems theory of the radio interferometer
N77-26203
The concept of antenna servocontrol — radio interferometer for satellite orbit determination
N77-26206
Antennas and central HF cabling — radio interferometer for satellite orbit determination
N77-26209
VHF interferometer receiver system for satellite orbit determination
N77-26210
Error sources of the receiver system — orbit determination radio interferometer
N77-26211
Software system of the interferometer computer
N77-26213
Computerized determination of the satellite direction — for orbit determination using radio interferometer
N77-26214
Calibration of the interferometer — satellite orbit determination system
N77-26215
ORBIT PERTURBATION
Updated dispersion analysis for the first Orbital Flight Test [OFT-1] mission
[NASA-CR-151434] N77-26174
ORBITAL MECHANICS
Updated dispersion analysis for the first Orbital Flight Test [OFT-1] mission
[NASA-CR-151434] N77-26174
Orbit transfer systems with emphasis on shuttle applications, 1986-1991
[NASA-TM-X-73394] N77-26198
ORGANIC COMPOUNDS
The potential of lignocellulosic materials for the production of chemicals, fuels, and energy
[PB-264458/1] N77-26698
Extractives as a renewable resource for industrial materials
[PB-264459/9] N77-26699
ORGANIC MATERIALS
The manifestation of the kinetic isotope effect during the decomposition of organic macromolecules
[NASA-TT-F-17450] N77-26240
ORGANIC PHOSPHORUS COMPOUNDS
Oxime therapy and oxime blood levels in rats: Dependence on the dose of the organophosphate
[MBL-1976-7] N77-26791
Selective enrichment and isolation of microorganisms on ethyl S-diisopropyl aminoethyl methylphosphonthioate [VX]
[CL-1975-27] N77-26793
ORGANIZATIONS
AGARD highlights 77/1 — research and development economics, policies, and the space transportation system
N77-26074
General Electric Company survey to define impact of statewide building codes on solar HVAC systems, commercial buildings. National Solar Demonstration Program
[COO-2683-76-11] N77-26674
OSCILLATIONS
Generation of internal waves by a moving region of pressures in a sea with a discontinuity layer
[AD-A036887] N77-26788
OSCILLATORS
Distributed feedback acoustic surface wave oscillator
[NASA-CASE-NPO-13673-1] N77-26919
OSMOSIS
Computer programs for the evaluation of activity and osmotic coefficients
[PB-262600/0] N77-27019
OSO-8
OSO-8 X-ray observations of AM Herculis
[NASA-TM-X-71313] N77-27050
OTS [ESA]
Improvement of OTS attitude control [during stationkeeping] using a microprocessor
[N-30-472-0] N77-26190
OXIDATION
Low temperature pressure-oxidation of silicon for integrated circuit technology
[AD-A035266] N77-26405
Oxidation of sulfur dioxide in power plant plumes
[BNL-21698] N77-26713
OXIDATION-REDUCTION REACTIONS
Factors affecting the open-circuit voltage and electrode kinetics of some iron/titanium redox flow cells
[NASA-TM-X-73669] N77-26612
OXIDIZERS
Inorganic halogen oxidizer research
[AD-A037421] N77-26259
OXYGEN ATOMS
Two photon excitation of atomic oxygen
[NASA-TM-X-71344] N77-26926
OXYGEN SUPPLY EQUIPMENT
Air-supply units of combination internal combustion engines
[BLL-RTS-9748] N77-26511
OZONE
Water vapor, nitric acid and ozone mixing ratio height profiles derived from spectral radiometric measurements
[AD-A037375] N77-26738
The transport of oxidant beyond urban areas. Compilation of data for the New England study, 1975
[PB-264205/6] N77-26784

P

PAINTS
Results of phase change paint heat transfer test utilizing 0.040-scale 50% forebody models [no. 82-0] of the Rockwell International Space Shuttle Orbiter in AEDC VKF hypersonic tunnel B [test OH54B]
[NASA-CR-151074] N77-26197
PAPERS
Environmental considerations of selected energy conserving manufacturing process options. Volume 5: Pulp and paper industry report
[PB-264271/8] N77-26682
PARABOLIC ANTENNAS
The complete electromagnetic fields in the focal region of a paraboloidal reflector
[AD-A035052] N77-26364
PARACHUTE DESCENT
Control of a gliding parachute system in a non-uniform wind
[AD-A036076] N77-26102
PARALLEL PLATES
An experimental investigation of the distribution function for the near free molecular parallel plate heat transfer problem
[UTIAS-210] N77-26426
PARALLEL PROGRAMMING
Vectorized general sparsity algorithms with backing store
[AD-A037971] N77-26892
PARAMAGNETIC RESONANCE
Theory and calculations on non-magnetic confinement of a dense plasma
[BLL-CTO-1291-[9091.9F]] N77-26962
PARAMETERIZATION
Interpolation of air pollution: A stochastic approach
[COO-2874-11] N77-26710
PARAMETRIC FREQUENCY CONVERTERS
Infrared upconversion for astronomy
[NASA-CR-153393] N77-27047
A sensitive infrared imaging up converter and spatial coherence of atmospheric propagation
[NASA-CR-149891] N77-27048
PARTIAL DIFFERENTIAL EQUATIONS
Preliminary documentation of GEARBI: Solution of ODE systems with block-iterative treatment of the Jacobian
[UCID-30149] N77-26839
Best rational approximations with negative poles to e to the -x power on [0, infinity]
[AD-A037559] N77-26888
Constructive function theoretic methods for higher order pseudoparabolic equations
[AD-A037671] N77-26889
PARTICLE ACCELERATION
Dynamics of a non-cylindrical Z-pinch and the particle acceleration mechanism
[BLL-CTO-1289-[9091.9F]] N77-26966
PARTICLE ACCELERATORS
Accelerator based atomic physics experiments: An overview
[CONF-761059-6] N77-26932
PARTICLE COLLISIONS
Negative ions in CO2
[AD-A037149] N77-26262
Two photon excitation of atomic oxygen
[NASA-TM-X-71344] N77-26926
PARTICLE EMISSION
Lectures on the new particles
[LBL-5500] N77-26939
PARTICLE INTERACTIONS
The kinetics of neutrals produced during the injection of an atom beam into the plasma
[BLL-CTO-1284-[9091.9F]] N77-26972
PARTICLE SIZE DISTRIBUTION
The effects of sintering parameters and particle size distribution on P/M steel forgings
[AD-A036983] N77-26303
National assessment of the urban particulate problem. Volume 2: Particle characterization
[PB-263666/0] N77-26716
PARTICLE TRAJECTORIES
Computed ion trajectories in thrustor beams
N77-26229
Bounce-averaged synchrotron loss in a dipole field
[AD-A037072] N77-26743
PARTICLES
Direct-inlet mass spectrometer for real-time analysis of particulate contaminants in air
[BNWL-SA-5645] N77-26704
Measurement techniques for inorganic trace materials in control system streams
[PB-264345/0] N77-26714
Particulate control mobile test units: Second year's operation
[PB-264067/0] N77-26721
PASSENGERS
A study of commuter air service
[NASA-CR-152005] N77-26108
PATTERN RECOGNITION
Network pattern processors
[AD-A037129] N77-26871
Applications of pattern theory to problems in computer science
[AD-A037128] N77-26875
Report of the 1976 Joint Workshop on Pattern Recognition and Artificial Intelligence
[AD-A037503] N77-26878
Feature extraction and recognition of two-dimensional data by the method of moments
[AD-A037445] N77-26879
Automatic pattern recognition in a multi-sensor environment
[AD-A037968] N77-26880
PAVEMENTS
Comparative performance of structural layers in pavement systems. Volume 4: Analysis of insulating layers in pavement test sections
[AD-A038116/0] N77-26168
Effects of pavement grooving on friction, braking, and vehicle control
[PB-264665/1] N77-26560
PDP COMPUTERS
Digital encoding for secure data communications
[AD-A035848] N77-26369
Computer interfacing at LASL
[LA-UR-76-2502] N77-26866
PDP 11 COMPUTER
Extended system modelling program - ESMP. Simulation of a large analogue computer on a PDP 11
[OUEL-1178/76] N77-26843
LASL integrated computer network
[LA-UR-76-2321] N77-26865
PENDULUMS
Program for trajectory calculation of pendulating projectiles
[ISL-R-104/76] N77-26917
The influence of support characteristics on the stability of an elastic system subjected to a circulatory force
[AD-A037929] N77-26918
PERFORATED PLATES
The analysis of reinforced holes in carbon fibre plates
N77-26556

PERFORMANCE PREDICTION
A nonlinear vertical-plane mathematical model for air cushion-supported vehicles
[AD-A037062] N77-26095
Prediction of test cell visible emissions
[AD-A037694] N77-26146
PERFORMANCE TESTS
Comparative performance of structural layers in pavement systems. Volume 4: Analysis of insulating layers in pavement test sections
[AD-A038116/0] N77-26168
Survey and experimental testing of nongravimetric mass measurement devices
[NASA-CR-151427] N77-26456
Introduction to basic solar cell measurements
[NASA-CP-2010] N77-26625
PERIODIC VARIATIONS
Magnetospheric magnetic field modeling
[AD-A037492] N77-26740
PERIODICALS
A study of coverage overlap among fourteen major science and technology abstracting and indexing services
[PB-264559/6] N77-27027
PERSONNEL
Techniques for the analysis of total energy and labor of industrial plants
[PB-264221/3] N77-26697
A study using infra red thermography of clothing assemblies for use by personnel working beneath operating helicopters
[AD-A035966] N77-26805
PERTURBATION THEORY
Application of system identification to analytic rotor modeling from simulated and wind tunnel dynamic test data, part 2
[NASA-CR-152023] N77-26078
Two photon excitation of atomic oxygen
[NASA-TM-X-71344] N77-26926
PERU
Application of remote sensing techniques for the study and evaluation of natural resources in Peru
[E77-10171] N77-26573
Application of remote sensing techniques for the study and evaluation of natural resources in Peru --- northern Amazon jungle, Ica City, and Nazca lines
[E77-10172] N77-26574
PETROGRAPHY
Lunar sample studies --- breccias basalts, and anorthosites
[NASA-SP-418] N77-27053
PETROLOGY
Evolution of silicic magma chambers and their relationship to basaltic volcanism
[LA-UR-76-1708] N77-26734
Characterization and distribution of lunar mare basalt types using remote sensing techniques
[NASA-CR-153267] N77-27051
PHARMACOLOGY
Studies in neuroendocrine pharmacology
[NASA-CR-153278] N77-26795
PHASE DIAGRAMS
The phase composition of alloys of the system Cr-Si-C
[BLL-M-25504-[5828.4F]] N77-26268
PHASE ERROR
Error sources of the receiver system --- orbit determination radio interferometer
N77-26211
PHASE SHIFT
Error sources of the receiver system --- orbit determination radio interferometer
N77-26211
PHASE SHIFT CIRCUITS
Manufacturing methods and technology measures for arc-plasma-sprayed phase-shifter elements
[AD-A037238] N77-26414
PHASE TRANSFORMATIONS
Development and qualification of PCM thermal capacitors. Part 1: Development of a 30 Wh PCM thermal capacitor --- temperature control of electronic components
[BMFT-FB-W-76-26-VOL-1] N77-26436
Development and qualification of PCM thermal capacitors. Part 2: Development of PCM thermal capacitor platforms and PCM thermal capacitor radiators --- satellite temperature control
[BMFT-FB-W-76-27-VOL-2] N77-26437
PHOSPHORIC ACID
Fuel cell stacks
[AD-A037586] N77-26641
Environmental considerations of selected energy conserving manufacturing process options. Volume 13: Phosphoric acid industry report
[PB-264279/1] N77-26690
PHOSPHORUS
Environmental considerations of selected energy conserving manufacturing process options. Volume 13: Phosphoric acid industry report
[PB-264279/1] N77-26690
PHOTOCHEMICAL REACTIONS
Nonequilibrium photochemical reactions induced by lasers
[MIT-2793-5] N77-26251
PHOTOCONDUCTORS
Development of sandwich structured photosensitive films for application to non-contact potentiometers
[AD-A037412] N77-26471
PHOTODISSOCIATION
Research on high-energy storage for laser amplifiers
[UCRL-13708] N77-26488
PHOTOGRAPHIC EQUIPMENT
Computer Output Microforms Program And Concept Study [COMPACS] report
[AD-A035992] N77-27029
PHOTOGRAPHIC FILM
The calibration of photographic and spectrographic films
[NASA-CR-152525] N77-26458
Development of an optical disc recorder --- using tellurium film
[AD-A037832] N77-26473
PHOTOINTERPRETATION
The use of remote sensing in solving Florida's geological and coastal engineering problems
[NASA-CR-153286] N77-26584
PHOTOMETRY
An interpretation of photometric parameters of bright desert regions of Mars and their dependence on wave length
[NASA-TN-D-8446] N77-27054
PHOTON ABSORPTIOMETRY
Evaluation of californium-252-based neutron radiography and photon scattering echniques for the inspection of hot iso-statically pressed components of T-700 aircraft engine
[AD-A036000] N77-26526
PHOTONS
Two photon excitation of atomic oxygen
[NASA-TM-X-71344] N77-26926
PHOTOOXIDATION
International Conference on Photochemical Oxidant Pollution and Its Control. Proceedings, volume 1
[PB-264232/0] N77-26717
International Conference on Photochemical Oxidant Pollution and Its Control. Proceedings, volume 2
[PB-264233/8] N77-26718
PHOTOSENSITIVITY
Development of sandwich structured photosensitive films for application to non-contact potentiometers
[AD-A037412] N77-26471
PHOTOSYNTHESIS
Hydrocarbons via photosynthesis
[LBL-5387] N77-26658
PHOTOVOLTAIC CELLS
Indoor and outdoor measurements of performance of photovoltaic arrays
[NASA-CP-2010] N77-26626
Temperature dependence of the photovoltaic performance of Si cells under blue, white, and near-bandgap irradiation
[UCRL-76203] N77-26652
PHOTOVOLTAIC EFFECT
Thin films
[BNL-21964] N77-26997
PHYSICAL PROPERTIES
Aerosol physical properties in the stratosphere [APPS] radiometer design
[NASA-CR-145199] N77-26732
Energy and physics
[ERDA-TR-225] N77-26916
PHYSIOLOGICAL EFFECTS
Aeromedical evaluation of UH-1 internal advanced personnel rescue hoists, Western Gear Corporation hoist models 42277R1 and 42305R1, Breeze Corporation hoist ECP-720 modification
[AD-A037621] N77-26130
Studies in neuroendocrine pharmacology
[NASA-CR-153278] N77-26795
PICOSECOND PULSES
Picosecond and nanosecond Nd: Glass high power laser amplifier system
[SAND-76-0432] N77-26482
PIEZOELECTRICITY
Research study in growth of aluminum-nitride on sapphire piezoelectric films
[AD-A037793] N77-26307
Piezoelectricity and pyroelectricity in crystalline polymers
[AD-A037606] N77-27004
Temperature compensated piezoelectric materials
[AD-A037796] N77-27013
PIEZORESISTIVE TRANSDUCERS
Stress-gage system for the megabar [100GPa] range
[AD-A035583] N77-26459
PILOT PERFORMANCE
Effects of direct side force control on pilot tracking performance
[AD-A036083] N77-26812
PINCH EFFECT
Dynamics of a non-cylindrical Z-pinch and the particle acceleration mechanism
[BLL-CTO-1289-[9091.9F]] N77-26966
PIONS
Biological effects of negative pions
[LA-UR-76-2529] N77-26799
PIPE FLOW
Transition in a boundary layer and in a pipe flow
[AD-A037664] N77-26453
PITCHING MOMENTS
Lift, circulation and pressure distributions for a foil oscillating in pitching motion in a perfect fluid
[UFD-1] N77-26422
PLANAR STRUCTURES
Planar CMOS/SOS array development
[AD-A037752] N77-27009
PLANNING
Planning of the interferometer antenna
N77-26208
PLASMA CHEMISTRY
Plasma chemistry processes in pulsed electric discharge lasers
[AD-A035036] N77-26497
PLASMA CONTROL
Investigation of plasma confinement in a device with a three-dimensional axis
[BLL-CTO-1286-[9091.9F]] N77-26963
Investigation of model thermonuclear systems with liners
[BLL-CTO-1290-[9091.9F]] N77-26968
Inertial confinement: A summary talk
[BLL-CTO-1300-[9091.9F]] N77-26970
Spectroscopic investigations of adiabatic compression in a Tokamak
[BLL-CTO-1282-[9091.9F]] N77-26971
PLASMA CYLINDERS
Equilibrium and MHD stability of a plasma in stellarators with three-dimensional axes
[BLL-RISLEY-TR-1285-[9091.9F]] N77-26967
PLASMA DENSITY
Measurement of the widths of emission lines from laser produced plasmas
[UCRL-78446] N77-26983
PLASMA ENGINES
Pulsed plasma plume studies
[AD-A036904] N77-26236
PLASMA FREQUENCIES
Hot electron production, anomalous absorption, and effect of intense electromagnetic fields on inverse bremsstrahlung absorption near the electron plasma frequency
[LA-UR-76-1951] N77-26982
PLASMA HEATING
Strong fast-rising magnetic fields in experiments on heating a dense plasma in a rapid theta pinch
[BLL-CTO-1287-[9091.9F]] N77-26964
Plasma heating in a toroidal system by a helical quadrupole RF field with omega omega sub Bi
[BLL-CTO-1292-[9091.9F]] N77-26965
Evaluation of the technical and economic feasibility of mirror fusion devices
[UCRL-13695] N77-26977
Current heating of plasma in the L-2 stellarator
[CONF-761012-29] N77-26979
PLASMA INTERACTIONS
The kinetics of neutrals produced during the injection of an atom beam into the plasma
[BLL-CTO-1284-[9091.9F]] N77-26972
Penetration of solar wind plasma elements into the magnetosphere
[AERONOMICA-ACTA-A-166-1976] N77-27055
PLASMA JETS
The initial stage of discharge development in Tokamaks
[BLL-CTO-1283-[9091.9F]] N77-26973
PLASMA PHYSICS
Status of Tokamak plasma physics
[PPPL-1296] N77-26978
Experimental and theoretical work in plasma physics
N77-26985
Marginal stability analysis: A simpler approach to anomalous transport in plasmas
[AD-A036916] N77-26989
PLASMA PINCH
Dynamics of a non-cylindrical Z-pinch and the particle acceleration mechanism
[BLL-CTO-1289-[9091.9F]] N77-26966
Investigation of model thermonuclear systems with liners
[BLL-CTO-1290-[9091.9F]] N77-26968
PLASMA SPRAYING
Manufacturing methods and technology measures for arc-plasma-sprayed phase-shifter elements
[AD-A037238] N77-26414
PLASMA TEMPERATURE
Measurement of the widths of emission lines from laser produced plasmas
[UCRL-78446] N77-26983
PLASMAS [PHYSICS]
Theory and calculations on non-magnetic confinement of a dense plasma
[BLL-CTO-1291-[9091.9F]] N77-26962
The controlled thermonuclear fusion research programme in the USSR for 1976 - 1977
[BLL-CTO-1296-[9091.9F]] N77-26969
Applied research in the general area of charged particle chemistry related to coal-fired MHD
[PB-263873/2] N77-26987
PLASTIC PROPERTIES
KOVEC user's manual --- coding elastic and plastic properties
[UCID-17306] N77-27018

PLATES [STRUCTURAL MEMBERS]
Buckling analysis of ship plate-structures — using NASTRAN program
[REPT-207-S] N77-26547
PLATING
Ion plating: Concepts and applications
[SAND-76-5459] N77-26515
PLOTTING
The computation and graphical display of the NSF Water Quality Index from the STORET data base using the integrated plotting package. Program documentation and users guide
[PB-264670/1] N77-27043
PLUMES
Oxidation of sulfur dioxide in power plant plumes
[BNL-21698] N77-26713
PLUNGERS
VISAR measurements of velocities in explosive valves
[SAND-76-8048] N77-26460
POINT DEFECTS
Point defect interactions and growth of dislocation loops
[CONF-761027-7] N77-27000
POINTS [MATHEMATICS]
Thinning of a point process over time
[AD-A037491] N77-26894
POISSON DENSITY FUNCTIONS
Thinning of a point process over time
[AD-A037491] N77-26894
POLAR REGIONS
VLF/LF reflectivity of the polar ionosphere, 20 July - 20 September 1975
[AD-A036913] N77-26376
Aerial ice reconnaissance and satellite ice information microfilm file
[AD-A037300] N77-26591
POLLUTION CONTROL
Bioconversion of agricultural wastes for pollution control and energy conservation
[TID-27164] N77-26675
International Conference on Photochemical Oxidant Pollution and Its Control. Proceedings, volume 1
[PB-264232/0] N77-26717
International Conference on Photochemical Oxidant Pollution and Its Control. Proceedings, volume 2
[PB-264233/8] N77-26718
Technical and economic evaluation of NOx control for coal-fired cyclone furnaces
[PB-264642/0] N77-26723
Enzyme process design for water treatment
[PB-264504/2] N77-27039
POLYCRYSTALS
Impurity effects on the creep of polycrystalline magnesium and aluminum oxides at elevated temperatures
[COO-1591-31] N77-26996
POLYMER PHYSICS
Break-up dynamics of polymer beads under laser bombardment
[AD-A037718] N77-26309
Piezoelectricity and pyroelectricity in crystalline polymers
[AD-A037606] N77-27004
POLYMERIZATION
Electroinitiated polymerization of monomers on metal electrodes
[AD-A036989] N77-26321
POLYMERS
Conformational analysis of polymers
[AD-A037092] N77-26317
Properties and structure of polymeric alloys
[AD-A037240] N77-26318
Proceedings of the TTCP-3 critical review: Techniques for the Characterization of Polymeric Materials
[AD-A036082] N77-26319
POLYSTYRENE
Thermophysical properties of polystyrene and poly[vinyl chloride]
[PB-265228/7] N77-26267
POLYVINYL CHLORIDE
Thermophysical properties of polystyrene and poly[vinyl chloride]
[PB-265228/7] N77-26267
POPULATION THEORY
Tables of required sample size for pairwise comparisons.
[AD-A035603] N77-26898
POROUS MATERIALS
The determination of the molecular weight distribution of polymers by permeation chromatography on porous glass. 1: Dextrans up to a molecular weight of 600000
[BLL-M-24884-[5828.4F]] N77-26246
PORTABLE EQUIPMENT
Modified AN/PSM-13 for field testing BA-4386/PRC-25 — zinc carbon batteries
[AD-A037002] N77-26180
Computer-based transportable data acquisition and control system
[UCRL-78339] N77-26813
POSITION [LOCATION]
Meteorological data, series A monographs. Volume 1, no. 2: Accuracy of locating distant thunderstorm centers with Heinrich Hertz Institute's VLF atmospherics analyzer N77-26768
POSITION INDICATORS
A dual electro-optical light image receiver and recorder
[AD-A037955] N77-26745
POTASSIUM ALLOYS
Experimental two-phase liquid-metal magnetohydrodynamic generator program
[AD-A035245] N77-26988
POTENTIOMETERS [RESISTORS]
Development of sandwich structured photosensitive films for application to non-contact potentiometers
[AD-A037412] N77-26471
POWDER METALLURGY
Magnetic fluid density separation system
[AD-A035639] N77-26256
Microstructure and mechanical properties of product from extrusion-consolidated 7075 Al prealloyed powder
[AD-A037188] N77-26301
POWER AMPLIFIERS
X-band power FET development
[AD-A035642] N77-26410
Picosecond and nanosecond Nd: Glass high power laser amplifier system
[SAND-76-0432] N77-26482
POWER CONDITIONING
Development of an integrated power module inverter
[AD-A035815] N77-26403
POWER EFFICIENCY
Solar array maximum power tracking with closed-loop control of a 30-centimeter ion thruster
[NASA-TM-X-73643] N77-26222
POWER PLANTS
Comparison of calculated and measured maximum aboveground air pollutant concentrations and their respective distances from the source of release of large power plants
[ORNL-TR-4231] N77-26712
Internalizing social costs in power plant siting: Some examples for coal and nuclear plants in the United States
[CONF-761103-16] N77-26816
POWER SPECTRA
The spectrum of the geoid from altimeter data
[NASA-TM-X-71337] N77-26567
PRECIPITATION [METEOROLOGY]
Simulation of cold cloud precipitation in a three-dimensional mesoscale model
[PB-265265] N77-26786
PREDICTION ANALYSIS TECHNIQUES
Experimental results for hydrocarbon exhaust infrared model verification
[AD-A037252] N77-26238
A computer program for the prediction of radiation from rocket exhaust plumes, volume 1
[AD-A037385] N77-26239
Design curves for structural response due to impact loading
[AD-A037011] N77-26513
Estimated winter wheat yield from crop growth predicted by LANDSAT
[NASA-CR-151431] N77-26580
PREMIXED FLAMES
Quenched flames with inhibitors: A theoretical analysis [theoretical analysis of quenched flames]
[BNL-21977] N77-26254
PRESSURE DISTRIBUTION
Effect of winglets on a first-generation jet transport wing. 3: Pressure and spanwise load distributions for a semispan model at Mach 0.30
[NASA-TN-D-8478] N77-26083
Heat transfer and pressure loss caused by coolant vaporization in a horizontal stream tube
[BLL-RTS-9956] N77-26419
Lift, circulation and pressure distributions for a foil oscillating in pitching motion in a perfect fluid
[UFD-1] N77-26422
Wall pressure fluctuations in a bubbly flow
[OUEL-1157/76] N77-26440
PRESSURE DRAG
Advancement of a method for calculating separated flows around airfoils with special consideration of profile drag
[ESA-TT-373] N77-26091
PRESSURE DROP
The calculation of two phase pressure drop by means of an annular flow model
[OUEL-1181/77] N77-26442
PRESSURE SENSORS
Stress-gage system for the megabar [100GPa] range
[AD-A035583] N77-26459
PRESSURE VESSELS
Failure analysis of pressure vessels with defects — maraging steel plate specimens
[OUEL-1168/76] N77-26550
PRIMARY BATTERIES
Report for BA 494/U
[AD-A035722] N77-26700
PRINTED CIRCUITS
Optimizing path printed circuit board router — for ILLIAC 4 computers
[UCRL-78564] N77-26408
PRINTOUTS
Computer Output Microforms Program And Concept Study [COMPACS] report
[AD-A035992] N77-27029
PROBABILITY DENSITY FUNCTIONS
Statistical measures, probability densities, and mathematical models for stochastic measurements
[AD-A037483] N77-26900
PROBLEM SOLVING
Application of hybrid finite elements to structure mechanics problems
[AD-A038016] N77-26563
Transactions of the 22nd Conference of Army Mathematicians
[AD-A037211] N77-26886
PROCUREMENT POLICY
Analysis of flight equipment purchasing practices of representative air carriers
[NASA-CR-154619] N77-27021
Laboratory equipment procurement
[LBL-5504] N77-27022
Study of US Army libraries, volume 1 — management methods
[AD-A036004] N77-27033
PRODUCTION ENGINEERING
NSF/RANN 4th Grantees' Conference on Production Research and Technology
[PB-265817/7] N77-26341
Hydrocarbons via photosynthesis
[LBL-5387] N77-26658
Research and development of low cost processes for integrated solar arrays
[COO-2721-76-1] N77-26670
Techniques for the analysis of total energy and labor of industrial plants
[PB-264221/3] N77-26697
Establishment of linear sequences
[BLL-RTS-10323] N77-26903
Research and development efforts relative to superconducting materials
[CONS/2551-1] N77-26998
PRODUCTION MANAGEMENT
Aircraft industry capacity study
[AD-A037837] N77-26071
PRODUCTIVITY
Agriculture aviation study and program plan. Volume 1: Project summary
[NASA-CR-153283] N77-26582
Agriculture aviation study and program plan. Volume 2: Supplemental information
[NASA-CR-153284] N77-26583
PROGRAMMING LANGUAGES
WAND demonstration
[AD-A037199] N77-26832
Abstraction and verification in Alphard: Introduction to language and methodology
[AD-A035487] N77-26833
Candidate languages evaluation report — Defense Department requirements
[AD-A037639] N77-26844
Candidate language evaluation and recommendation report — Defense Department requirements
[AD-A037638] N77-26845
IMAG-3: Non-linear circuit analysis — program for electronic circuit simulation at component level N77-26906
SIMULA: A high-level general-purpose discrete events simulation N77-26909
PROJECT PLANNING
Project Skywater: Atmospheric water resources program
[PB-263952/4] N77-26785
Methodology and planning for a microprocessor-oriented real time controller design automation system
[UCID-17318] N77-26814
PROJECTILES
Program for trajectory calculation of pendulating projectiles
[ISL-R-104/76] N77-26917
PROJECTIVE GEOMETRY
Geographic data base development
[AD-A037116] N77-26823
PROPELLANT STORAGE
Explosive tests for establishing hazard classification for M1 SP propellant in automated single-base finishing operations
[AD-A037383] N77-26336
PROPELLER BLADES
Boron/aluminum fan blades for SCAR engines
[NASA-CR-135184] N77-26135
PROPELLER FANS
Boron/aluminum fan blades for SCAR engines
[NASA-CR-135184] N77-26135
PROPULSION SYSTEM CONFIGURATIONS
Investigation of beamed energy concepts for propulsion. Volume 1: Systems studies
[AD-A034995] N77-26491

PROPULSION SYSTEM PERFORMANCE
Performance, emissions, and physical characteristics of a rotating combustion aircraft engine
[NASA-CR-135119] N77-26134
Reliability estimating procedures for electric and thermochemical propulsion systems, volume I
[AD-A037745] N77-26234
PROPULSIVE EFFICIENCY
Influence of power on the spin of light planes
[NASA-TT-F-17447] N77-26152
PROTECTIVE CLOTHING
Non-reflective, wettable, fibrous fabric assemblies for firefighters' clothing
[AD-A038028] N77-26320
A study using infra red thermography of clothing assemblies for use by personnel working beneath operating helicopters
[AD-A035966] N77-26805
PUBLIC HEALTH
STARPAHC operational report
[NASA-CR-151432] N77-26794
PULSE AMPLITUDE
Electro-mechanical sine/cosine generator
[NASA-CASE-LAR-11389-1] N77-26387
PULSE CODE MODULATION
Measurement of long-term phase jitter in stuffing multiplex systems for PCM and data signals
[BLL-PO-TRANS-3407-[9022.81]] N77-26343
PULSE COMMUNICATION
Digital encoding for secure data communications
[AD-A035848] N77-26369
Advanced monitoring techniques for digital communication systems
[AD-A037082] N77-26380
A microprocessor-based bit error performance monitor
[AD-A037612] N77-26825
PULSE GENERATORS
Compact electron accelerator for pumping gas lasers
[UCRL-78537] N77-26487
PULSE RADAR
GSFC short pulse radar, JONSWAP-75
[NASA-TN-D-8502] N77-26457
PULSED JET ENGINES
Pulsating combustion device miniaturization
[AD-A035707] N77-26147
PULSED LASERS
Isotope separation using metallic vapor lasers
[NASA-CASE-NPO-13550-1] N77-26477
A simple, high-power, low-cost nitrogen laser for dye laser pumping
[AD-A035580] N77-26506
PULSED RADIATION
Thermal radiative losses from graphite calorimeters used in pulsed electron beam experiments
[AD-A037754] N77-26475
Development of spectrophones for CW and pulsed radiation sources
[AD-A035594] N77-26489
PURSUIT TRACKING
Minimum energy control of a bilinear pursuit-evasion system
[AD-A037556] N77-26187
PYRANOMETERS
Results from circumsolar radiation measurements
[LBL-5292] N77-26657
PYROELECTRICITY
Piezoelectricity and pyroelectricity in crystalline polymers
[AD-A037606] N77-27004
PYROLYSIS
The thermal decomposition of 2, 3, 4, 6-tetranitromethyl beta-d-glucopyranoside
[AD-A035584] N77-26257
PYROTECHNICS
Documentation of the feasibility research on a destructible parachute
[SAND-76-0111] N77-26087

Q

Q SWITCHED LASERS
Break-up dynamics of polymer beads under laser bombardment
[AD-A037718] N77-26309
QUADRUPOLE NETWORKS
Plasma heating in a toroidal system by a helical quadrupole RF field with omega omega sub Bi
[BLL-CTO-1292-[9091.9F]] N77-26965
QUALITY CONTROL
Evaluation of californium-252-based neutron radiography and photon scattering echniques for the ins ection of hot iso-statically pressed components of T-700 aircraft engine
[AD-A036000] N77-26526
QUANTUM MECHANICS
Lectures on the new particles
[LBL-5500] N77-26939
QUATERNIONS
Euler angles, quaternions, and transformation matrices for space shuttle analysis
[NASA-CR-151435] N77-26175
QUENCHING [COOLING]
Quenched flames with inhibitors: A theoretical analysis [theoretical analysis of quenched flames]
[BNL-21977] N77-26254
Effect of percentage bainite formed at 400 deg C on the fracture toughness properties of as-quenched HY130
[AD-A035948] N77-26291

R

RADAR ANTENNAS
Effect of multipath on the height-finding capabilities of a fixed-reflector radar system. Part 3: Effect of radome
[AD-A037957] N77-26356
RADAR ATTENUATION
A depolarization and attenuation experiment using the CTS satellite --- meteorological radar
[NASA-CR-152535] N77-26347
RADAR BEACONS
System definition and investigation of the on site processing of en route sensor signals. Volume 1: Summary of results, system definition, radar processing
[AD-A038491/7] N77-26115
System definition and investigation of the on site processing of en route sensor signals. Volume 2: Beacon processing investigation
[AD-A038492/5] N77-26116
System definition and investigation of the on site processing of en route sensor signals. Volume 3: Appendices
[AD-A038493/3] N77-26117
RADAR CROSS SECTIONS
Erosion protection for the AH-1 G low radar cross-section main rotor blade. Volume 1: Sand and rain erosion evaluation
[AD-A035961] N77-26123
RADAR IMAGERY
Feature extraction and recognition of two-dimensional data by the method of moments
[AD-A037445] N77-26879
RADAR RANGE
Radar range calibrator system evaluation report
[AD-A037134] N77-26179
RADAR SIGNATURES
System definition and investigation of the on site processing of en route sensor signals. Volume 1: Summary of results, system definition, radar processing
[AD-A038491/7] N77-26115
System definition and investigation of the on site processing of en route sensor signals. Volume 2: Beacon processing investigation
[AD-A038492/5] N77-26116
System definition and investigation of the on site processing of en route sensor signals. Volume 3: Appendices
[AD-A038493/3] N77-26117
RADIATION ABSORPTION
Use of X-ray scattering in absorption corrections for X-ray fluorescence analysis of loaded filters
[BNWL-SA-5755] N77-26249
RADIATION COUNTERS
Scatha satellite instrumentation report: Thermal plasma analyzer; rapid scan particle detector; electron beam system; positive ion beam system
[AD-A035506] N77-26185
RADIATION DAMAGE
Thermal radiative losses from graphite calorimeters used in pulsed electron beam experiments
[AD-A037754] N77-26475
Stresses produced in a long cylinder by a nuclear thermal environment
[AD-A037426] N77-26539
International Conference on Radiation Effects in Semiconductors
[AD-A036994] N77-26936
RADIATION DETECTORS
The development of a parallel-channel spectrographic detector: Applications to Raman scattering
[AD-A037407] N77-26265
Low background Ge[Li] detector with anticoincidence NaI annulus [revised] --- for soil samples
[EGG-1183-2326-REV] N77-26463
RADIATION DOSAGE
Cesium-137 whole-body content in a normal New Mexico population
[LA-UR-76-2097] N77-26798
RADIATION EFFECTS
Interface states in Schottky barrier diodes
[AD-A035720] N77-26412
RADIATION MEASUREMENT
Results from circumsolar radiation measurements
[LBL-5292] N77-26657
Radionuclidic impurities in 99Mo[99m] Tc generators, their measurements and importance
[BLL-RTS-10018] N77-26925
RADIATION PROTECTION
Evaluation of a laser equipped rifle for the US Army Human Engineering Laboratory, Aberdeen Proving Ground, Maryland, 19 January 1977
[AD-A037615] N77-26508
In vitro evaluation of some latent radioprotective compounds --- cysteamine derivatives
[MBL-1976-11] N77-26792
RADIATION SHIELDING
The shielding of a 14 MeV neutron generator
[MRL-TN-387] N77-26937
RADIATION SOURCES
Radionuclidic impurities in 99Mo[99m] Tc generators, their measurements and importance
[BLL-RTS-10018] N77-26925
RADIATION SPECTRA
Errors in short circuit measurements due to spectral mismatch between sunlight and solar simulators
[NASA-CR-2010] N77-26620
RADIATION THERAPY
A cervix-to-rectum measuring device in a radiation applicator for use in the treatment of cervical cancer
[NASA-CASE-GSC-12081-2] N77-26796
Biological effects of negative pions
[LA-UR-76-2529] N77-26799
RADIATIVE TRANSFER
Theoretical research in physics of highly ionized atoms
[COO-2557-1] N77-26931
RADIO BEACONS
DABS monopulse summary --- monopulse azimuth estimation
[AD-A038157/4] N77-26114
RADIO COMMUNICATION
Local, regional and large scale integrated networks. Volume 2. Recent advances in ground packet radio systems
[AD-A035950] N77-26351
RADIO FREQUENCY INTERFERENCE
Principles and applications of adaptive filters: A tutorial review
[AD-A037755] N77-26357
RADIO INTERFEROMETERS
The DFVLR radio interferometer --- satellite orbit determination
[BMFT-FB-W-76-25] N77-26201
Outline of the interferometer station N77-26202
Systems theory of the radio interferometer N77-26203
Mechanical accuracy of the antenna rotary drive and its testing N77-26204
Construction details of the interferometer rotary drive N77-26205
The concept of antenna servocontrol --- radio interferometer for satellite orbit determination N77-26206
Technical details of the control and drive systems --- radio interferometer antennas N77-26207
Planning of the interferometer antenna N77-26208
Antennas and central HF cabling --- radio interferometer for satellite orbit determination N77-26209
VHF interferometer receiver system for satellite orbit determination N77-26210
Error sources of the receiver system --- orbit determination radio interferometer N77-26211
Automatic computer controlled operation of the interferometer installation --- satellite orbit determination N77-26212
Software system of the interferometer computer N77-26213
Computerized determination of the satellite direction --- for orbit determination using radio interferometer N77-26214
Calibration of the interferometer --- satellite orbit determination system N77-26215
RADIO RANGE
Computational study of long-range high-frequency ionospheric ducting
[AD-A035502] N77-26378
RADIO RELAY SYSTEMS
Advanced monitoring techniques for digital communication systems
[AD-A037082] N77-26380
RADIO SIGNALS
Computational study of long-range high-frequency ionospheric ducting
[AD-A035502] N77-26378
RADIO TRANSMISSION
Effects of antenna elevation and inclination on VLF/LF signal structure
[AD-A035510] N77-26365

RADIOACTIVE CONTAMINANTS
Radionuclidic impurities in 99Mo[99m] Tc generators, their measurements and importance
[BLL-RTS-10018] N77-26925
RADIOACTIVE ISOTOPES
Radionuclidic impurities in 99Mo[99m] Tc generators, their measurements and importance
[BLL-RTS-10018] N77-26925
RADIOACTIVITY
Measuring the radioactivity of drinking water with the liquid counters M2H in combination with contamination meters IM 4457
[MBL-1976-10] N77-26934
RADIOGRAPHY
Evaluation of californium-252-based neutron radiography and photon scattering echniques for the inspection of hot iso-statically pressed components of T-700 aircraft engine
[AD-A036000] N77-26526
Radiographic analysis of sedimentary structures and depositional histories in Apollo 15 cores
[NASA-CR-153265] N77-27052
RADIOLYSIS
Radiolysis studies on reactive intermediates
[COO-2086-87] N77-26930
RADIOMETERS
Results of UHF radiometric and direct ground measurements of soil moisture in 1975
[NASA-TT-F-17521] N77-26726
Aerosol physical properties in the stratosphere [APPS] radiometer design
[NASA-CR-145199] N77-26732
RADOMES
Effect of CW-396A radome on the radiation pattern of rectangular antennas
[AD-A036960] N77-26355
Effect of multipath on the height-finding capabilities of a fixed-reflector radar system. Part 3: Effect of radome
[AD-A037957] N77-26356
RAIN
Erosion protection for the AH-1 G low radar cross-section main rotor blade. Volume 1: Sand and rain erosion evaluation
[AD-A035961] N77-26123
RAIN FORESTS
Application of remote sensing techniques for the study and evaluation of natural resources in Peru --- northern Amazon jungle, Ica City, and Nazca lines
[E77-10172] N77-26574
RAIN IMPACT DAMAGE
A depolarization and attenuation experiment using the CTS satellite --- meteorological radar
[NASA-CR-152535] N77-26347
RAMAN SPECTRA
Resonant Raman scattering in GaSe and GaS[x]Se[1-x]
[LBL-5456] N77-26993
Optical properties of layer compounds Ga s sub x Se sub 1-x
[LBL-5464] N77-26994
RAMAN SPECTROSCOPY
The development of a parallel-channel spectrographic detector: Applications to Raman scattering
[AD-A037407] N77-26265
A laser Raman system for obtaining N2 and CO2 concentrations in probe-sampled combustion gases
[AD-A037563] N77-26502
RANDOM ERRORS
Updated dispersion analysis for the first Orbital Flight Test [OFT-1] mission
[NASA-CR-151434] N77-26174
RANDOM NOISE
Spectral characteristics of a flicker noise model
[MRL-R-680] N77-26881
RANDOM PROCESSES
Space/time random processes and optimum array processing
[AD-A035593] N77-26379
A mathematical study of a random process proposed as an atmospheric turbulence model
[NASA-CR-145200] N77-26897
RANDOM VARIABLES
Transformation yielding reliability models based on independent random variables: A survey
[AD-A037969] N77-26527
Thinning of a point process over time
[AD-A037491] N77-26894
RANGE FINDERS
Radar range calibrator system evaluation report
[AD-A037134] N77-26179
RANGE SAFETY
Presentation of missile flight information
[AD-A037756] N77-26193
RANGEFINDING
A technique for measuring optical line of sight
[AD-A037191] N77-26609
RANKING
Candidate languages evaluation report --- Defense Department requirements
[AD-A037639] N77-26844
Candidate language evaluation and recommendation report --- Defense Department requirements
[AD-A037638] N77-26845
RARE EARTH ELEMENTS
Inhibition of hydrogen embrittlement in high strength steel
[AD-A037355] N77-26304
RAREFIED GASES
The problem of a blunt body in a rarefied supersonic flow
[REPT-75-3] N77-26088
RATS
Acquisition and activity in aged rats
[MBL-1976-4] N77-26789
Oxime therapy and oxime blood levels in rats: Dependence on the dose of the organophosphate
[MBL-1976-7] N77-26791
REACTION KINETICS
Investigation of the relationship between quasi-global and detailed kinetics mechanisms for the combustion of methane
[UCRL-78424] N77-26255
Complex formation in metal dissolution and metal treatment
[AD-A037404] N77-26305
Determination of negative ion mass spectra of some explosives --- ortho-, para-, di- and trinitrotoluene
[ISL-R-126/75] N77-26327
REACTION TIME
Delay of visual feedback in aircraft simulators
[AD-A037839] N77-26169
Absolute rate constant for the reaction of atomic chlorine with hydrogen peroxide vapor over the temperature range 265-400 K
[NASA-TM-X-71340] N77-26248
REACTION WHEELS
An evaluation of reaction wheel emitted vibrations for space telescope
[NASA-CR-150303] N77-26181
REACTIVITY
Radiolysis studies on reactive intermediates
[COO-2086-87] N77-26930
REACTOR DESIGN
Conceptual design study of a noncircular Tokamak demonstration fusion power reactor
[GA-A-13992] N77-26981
REACTOR PHYSICS
Energy dependent finite element method for two-dimensional diffusion problems
[LA-UR-77-59] N77-26940
REACTOR SAFETY
A microcomputer-based reactor safety system
[OUEL-1159/76] N77-26941
REAL GASES
Investigation of real-gas and viscous effects on the aerodynamic characteristics of a 40 deg half-cone with suggested correlations for the shuttle orbiter
[NASA-TN-D-8418] N77-26081
REAL TIME OPERATION
Digital reconstruction of a coded image obtained with a nonredundant pinhole array
[LA-UR-76-1789] N77-26464
Methodology and planning for a microprocessor-oriented real time controller design automation system
[UCID-17318] N77-26814
RECEIVERS
VHF interferometer receiver system for satellite orbit determination
N77-26210
Error sources of the receiver system --- orbit determination radio interferometer
N77-26211
Hardware simulation of KU-band spacecraft receiver and bit synchronizer, phase 2, volume 1 --- for space shuttle
[NASA-CR-151439] N77-26348
RECIPROCAL THEOREMS
Applying the reciprocity principle to solving heat conductivity problems
[AD-A037450] N77-26427
RECORDING
Geophysical well logging for geohydrological purposes in unconsolidated formations
N77-26598
RECTANGULAR PANELS
Stability of flat, clamped, rectangular sandwich panels subjected to combined inplane loadings
[AD-A037489] N77-26564
RECTANGULAR PLATES
The singularity expansion representation of the transient electromagnetic coupling through a rectangular aperture
[AD-A036999] N77-26374
The singularity expansion representation of the transient electromagnetic coupling through a rectangular aperture
[AD-A037353] N77-26375
RECTIFIERS
Functioning of power rectifiers and thyristors --- forward characteristics, shorted emitter, switching response, and reverse capability
[ESA-TT-389] N77-26402
REENTRY EFFECTS
Calculating the ablation of large spheres entering the atmosphere at meteoric velocities
[SAND-76-0311] N77-26178
REENTRY VEHICLES
Application of light-initiated explosive for simulating X-ray blowoff impulse effects on a full scale reentry vehicle
[SAND-76-9019] N77-26189
Stability and transition in boundary layers on reentry vehicle nosetips
[AD-A035712] N77-26449
REFINING
XRF analysis of some regenerated catalysts
[MRL-TN-388] N77-26247
Environmental considerations of selected energy conserving manufacturing process options. Volume 4: Petroleum refining industry report
[PB-264270/0] N77-26681
REFLECTANCE
VLF/LF reflectivity of the polar ionosphere, 20 July - 20 September 1975
[AD-A036913] N77-26376
REFRACTION
Cavity detection by means of seismic shear and compressional wave refraction techniques
[TID-27225] N77-26733
REFRACTIVITY
Determination of the light quantum survival parameter from the characteristics of light fields in the sea
[AD-A036879] N77-26953
Optical materials characterization --- refractive indices of chemical vapor deposited ZnS
[AD-A037525] N77-26960
REFRACTORY MATERIALS
Application of sputter-deposited lamellar composite technology to the development of high temperature turbine blade materials and airfoil fabrication
[AD-A037349] N77-26151
REFRIGERANTS
Calculation of the heat transfer to boiling refrigerators
[BLL-RTS-9959] N77-26418
REGENERATION [ENGINEERING]
A numerical model to evaluate the behavior of a regenerative heat exchanger at high temperature --- for magnetohydrodynamic generator
[TH-76-E-66] N77-26439
REGIONAL PLANNING
Regional land use and energy modeling
[BNL-21809] N77-26595
Weather, climate and human settlements
[WMO-448] N77-27038
REGRESSION ANALYSIS
Discrimination of alternative hydrologic regression models: A user's manual
[PB-264285/8] N77-26607
REGULATIONS
General Electric Company survey to define impact of statewide building codes on solar HVAC systems, commercial buildings. National Solar Demonstration Program
[COO-2683-76-11] N77-26674
REINFORCED PLASTICS
Optimization of the characteristics of structural reinforced plastics. Part I: General theory
[CRIF-PL-10] N77-26315
REINFORCING FIBERS
An experimental method to produce uniform plane stress states with application to fiber reinforced materials
[AD-A037979] N77-26244
RELATIVISTIC VELOCITY
Calculating the ablation of large spheres entering the atmosphere at meteoric velocities
[SAND-76-0311] N77-26178
Assessment of relative velocity as independent variable for space shuttle first stage guidance attitude command tables
[NASA-CR-151436] N77-26199
RELIABILITY
Transformation yielding reliability models based on independent random variables: A survey
[AD-A037969] N77-26527
Update to reliability and maintainability planning guide for Army aviation systems and components
[AD-A037446] N77-26528
Applications of human performance reliability evaluation concepts and demonstration guidelines
[AD-A037632] N77-26809
RELIABILITY ANALYSIS
Digital Avionics Information System [DAIS]: Current maintenance task analysis
[AD-A035683] N77-26132
Reliability estimating procedures for electric and thermochemical propulsion systems, volume 2
[AD-A037748] N77-26235
The effects of periodic cable defects upon the transmission of wideband signals
[BLL-TRANS-3433-[9022.81]] N77-26344
Reliability data for fluidic systems
[AD-A035724] N77-26451
Instrumentation calibration --- national and international standardization for laboratory equipment
[LBL-5506] N77-26466
Laboratory verification of force determination, a potential tool for reliability testing
[AD-A035960] N77-26523

A practical guide to reliability
[AD-A037611] N77-26524
NASA software specification and evaluation system: Software verification/validation techniques
[NASA-CR-150299] N77-26828
Quantitative methods for software reliability measurements
[AD-A035585] N77-26849
RELIABILITY ENGINEERING
The effect of reliability and maintainability on the F-14A TF30P412A engine
[AD-A037985] N77-26525
RELIEF VALVES
VISAR measurements of velocities in explosive valves
[SAND-76-8048] N77-26460
RELUCTANCE
On the calculation of permeances and forces between doubly slotted structures — reluctance stepping motors
[TH-76-E-65] N77-26400
REMOTE CONTROL
Remote manipulator system steering capability for SVDS
[NASA-CR-151438] N77-26804
How to use the CDC 6600 G-machine from a remote terminal
[UCID-30095] N77-26835
REMOTE REGIONS
Measurements of background hydrocarbons in remote areas
[AD-A037361] N77-26725
REMOTE SENSORS
Analysis of laser fluorosensor systems for remote algae detection and quantification
[NASA-TN-D-8447] N77-26480
Remote sensing program — Cornell University program
[NASA-CR-153288] N77-26568
Remote sensing in Michigan for land resource management
[NASA-CR-153392] N77-26578
Remote sensing of effects of land use practices on water quality
[NASA-CR-150306] N77-26581
The use of remote sensing in solving Florida's geological and coastal engineering problems
[NASA-CR-153286] N77-26584
Applications of remote sensing to estuarine management
[NASA-CR-153287] N77-26585
Application of remote sensing to state and regional programs
[NASA-CR-153279] N77-26586
Remote sensing of wetlands
[NASA-CR-153282] N77-26588
Advanced Sensors and Applications Study [ASAS]
[NASA-CR-151441] N77-26590
An algorithm to retrieve water vapor information from satellite measurements
[AD-A037405] N77-26747
REMOTELY PILOTED VEHICLES
Aerodynamic configuration development of the highly maneuverable aircraft technology remotely piloted research vehicle
[NASA-CR-143841] N77-26076
REPLACING
Analysis of flight equipment purchasing practices of representative air carriers
[NASA-CR-154619] N77-27021
REPORTS
Experimental and theoretical work in plasma physics
N77-26985
RESCUE OPERATIONS
Aeromedical evaluation of UH-1 internal advanced personnel rescue hoists, Western Gear Corporation hoist models 42277R1 and 42305R1, Breeze Corporation hoist ECP-720 modification
[AD-A037621] N77-26130
Development of smoke abated aircraft crash/rescue fire fighting trainer
[AD-A035999] N77-26260
RESEARCH AIRCRAFT
Aerodynamic configuration development of the highly maneuverable aircraft technology remotely piloted research vehicle
[NASA-CR-143841] N77-26076
Airframe, wing, and tail aerodynamic characteristics of a 1/6-scale model of the rotor systems research aircraft with the rotors removed
[NASA-TN-D-8456] N77-26082
RESEARCH AND DEVELOPMENT
AGARD highlights 77/1 — research and development economics, policies, and the space transportation system
N77-26074
RESEARCH FACILITIES
Experimental and theoretical work in plasma physics
N77-26985
Ames research center publications, 1975
[NASA-TM-X-73245] N77-27063
RESEARCH PROJECTS
Ames research center publications, 1975
[NASA-TM-X-73245] N77-27063
RESERVOIRS
Evaluation of Solaris water-trickle solar collector and demonstration of annual cycle collection and storage of solar heated water
[CONF-761143-1] N77-26669
RESOLUTION
A sensitive infrared imaging up converter and spatial coherence of atmospheric propagation
[NASA-CR-149891] N77-27048
RESONANCE SCATTERING
Resonant Raman scattering in GaSe and GaS[x]Se[1-x]
[LBL-5456] N77-26993
RESOURCES MANAGEMENT
ACS. 1: An experimental management tool
[AD-A037311] N77-27023
RESPIRATORY SYSTEM
Influence of altered gaseous environments on lung metabolism
[AD-A037977] N77-26801
RETRACTABLE EQUIPMENT
Design selection tests for TRAC retraction mechanism
[AD-A037307] N77-26129
REVIEWING
Project Skywater: Atmospheric water resources program
[PB-263952/4] N77-26785
RIBBON PARACHUTES
Documentation of the feasibility research on a destructible parachute
[SAND-76-0111] N77-26087
RIGID STRUCTURES
Composite sandwich lattice structure
[NASA-CASE-LAR-11898-2] N77-26242
ROCKET EXHAUST
A summary of jet plume effects on the stability characteristics of a body of revolution with various fin configurations at Mach numbers from 0.2 to 2.3 normal jet plume simulator
[AD-A037356] N77-26084
Determination of the excited state density distribution within a nonequilibrium, freely expanding argon arcjet plume
[AD-A037352] N77-26145
Pulsed plasma plume studies
[AD-A036904] N77-26236
Experimental results for hydrocarbon exhaust infrared model verification
[AD-A037252] N77-26238
A computer program for the prediction of radiation from rocket exhaust plumes, volume I
[AD-A037385] N77-26239
ROCKET LAUNCHING
Trajectory determination and telemetry receiving system evaluation
[AD-A037959] N77-26216
ROCKET-BORNE INSTRUMENTS
Design, construction, test and field support of a containerless payload package for rocket flight — electromagnetic heating and confinement
[NASA-CR-149997] N77-26184
ROCKS
Application of standard photogeologic techniques to LANDSAT imagery for mineral exploration in the basin and range province of Utah and Nevada
[E77-10170] N77-26572
ROLL
The effectiveness of canards for roll control
[AD-A037077] N77-26160
ROTARY WING AIRCRAFT
Laboratory verification of force determination, a potential tool for reliability testing
[AD-A035960] N77-26523
ROTARY WINGS
Research requirements for development of improved helicopter rotor efficiency
[NASA-CR-145117] N77-26121
Erosion protection for the AH-1 G low radar cross-section main rotor blade. Volume 1: Sand and rain erosion evaluation
[AD-A035961] N77-26123
Design selection tests for TRAC retraction mechanism
[AD-A037307] N77-26129
ROTATING CYLINDERS
Analysis of magnetic suspension — for energy storage by rotating cylinders
[SAND-76-0532] N77-26648
ROTATING DISKS
Development of an optical disc recorder — using tellurium film
[AD-A037832] N77-26473
ROTATING PLASMAS
Experiments with a large sized hollow cathode discharge, part 3 — plasma rotation
[TH-76-E-67] N77-26986
ROTOR AERODYNAMICS
Unsteady hovering wake parameters identified from dynamic model tests, part I
[NASA-CR-152022] N77-26077
ROTOR BLADES
Flap/lag/torsion dynamics of a uniform, cantilever rotor blade in hover
[NASA-TM-73248] N77-26068
Unsteady hovering wake parameters identified from dynamic model tests, part 1
[NASA-CR-152022] N77-26077
ROTOR BLADES [TURBOMACHINERY]
Finite element stability analysis for coupled rotor and support systems
[NASA-CR-152024] N77-26079
Design selection tests for TRAC retraction mechanism
[AD-A037307] N77-26129
Electroless-nickel plating of a large turbine rotor for the geothermal program
[UCID-17253] N77-26286
ROTOR SPEED
An evaluation of reaction wheel emitted vibrations for space telescope
[NASA-CR-150303] N77-26181
RUBY LASERS
Microsecond holographic interferometer for fracture studies
[UCRL-52161] N77-26462
RURAL AREAS
STARPAHC operational report
[NASA-CR-151432] N77-26794

S

S WAVES
Cavity detection by means of seismic shear and compressional wave refraction techniques
[TID-27225] N77-26733
SAFETY FACTORS
Estimation of UG3RD safety benefits
[AD-A036895] N77-26109
Engine performance and fire-safety characteristics of water-containing diesel fuels
[AD-A036011] N77-26330
SAFETY MANAGEMENT
Explosive tests for establishing hazard classification for M1 SP propellant in automated single-base finishing operations
[AD-A037383] N77-26336
A microcomputer-based reactor safety system
[OUEL-1159/76] N77-26941
SAMPLES
Lunar sample studies — breccias basalts, and anorthosites
[NASA-SP-418] N77-27053
SAMPLING
Comparison of wet chemical and instrumental methods for measuring airborne sulfate
[PB-264201/5] N77-26719
The transport of oxidant beyond urban areas. Compilation of data for the New England study, 1975
[PB-264205/6] N77-26784
SAN ANDREAS FAULT EXPERIMENT
Resurvey of site stability quadrilaterals, Otay Mountain and Quincy, California — San Andreas fault experiment
[NASA-CR-149155] N77-26728
SANDS
Erosion protection for the AH-1 G low radar cross-section main rotor blade. Volume 1: Sand and rain erosion evaluation
[AD-A035961] N77-26123
Casting titanium and zirconium in zircon sand molds
[PB-264253/6] N77-26292
SANDWICH STRUCTURES
Composite sandwich lattice structure
[NASA-CASE-LAR-11898-2] N77-26242
Development of sandwich structured photosensitive films for application to non-contact potentiometers
[AD-A037412] N77-26471
Damage tolerance of thin skin sandwich panels
[AD-A037526] N77-26559
Stability of flat, clamped, rectangular sandwich panels subjected to combined inplane loadings
[AD-A037489] N77-26564
SAPPHIRE
Investigation of defects and impurities in silicon-on-sapphire
[AD-A037753] N77-27011
SATELLITE ATTITUDE CONTROL
Improvement of OTS attitude control [during stationkeeping] using a microprocessor
[N-30-472-0] N77-26190
SATELLITE NETWORKS
Analysis of the ARPA satellite circuit between Etam, W. Va., and Goonhilly, UK and proposed improvements to the circuit design
[AD-A037675] N77-26194
Local, regional and large scale integrated networks: Volume 1. Large networks for defense communications: Strategies, performance measures and cost trends
[AD-A035949] N77-26350
Towards a global operational system of meteorological satellites
N77-26759
SATELLITE OBSERVATION
Skylab S191, S192 program descriptions — earth radiation data analysis
[NASA-CR-152508] N77-26177

SATELLITE ORBITS
The DFVLR radio interferometer --- satellite orbit determination
[BMFT-FB-W-76-25] N77-26201
Computerized determination of the satellite direction --- for orbit determination using radio interferometer
N77-26214
Calibration of the interferometer --- satellite orbit determination system
N77-26215

SATELLITE TEMPERATURE
Development and qualification of PCM thermal capacitors. Part 2: Development of PCM thermal capacitor platforms and PCM thermal capacitor radiators --- satellite temperature control
[BMFT-FB-W-76-27-VOL-2] N77-26437

SATELLITE TRANSMISSION
Manual for adjustment and handling of platforms for data collection via satellite [CDCP]
[NASA-TM-75020] N77-26182
On-orbit performance of the 12 GHz, 200 watt transmitter experiment package for CTS
[NASA-TM-X-73636] N77-26183

SATELLITE-BORNE INSTRUMENTS
Scatha satellite instrumentation report: Thermal plasma analyzer; rapid scan particle detector; electron beam system; positive ion beam system
[AD-A035506] N77-26185

SATELLITE-BORNE PHOTOGRAPHY
The influence of space techniques on the development of meteorology
N77-26758

SCALE MODELS
Low speed wind tunnel tests of 1/10-scale model of a blended-arrow supersonic cruise aircraft
[NASA-TN-D-8410] N77-26069

SCANDIUM
Low temperature heat capacity of scandium and scandium alloys
[IS-M-72] N77-26285

SCANDIUM COMPOUNDS
Low temperature heat capacity of scandium and scandium alloys
[IS-M-72] N77-26285

SCHOTTKY DIODES
Interface states in Schottky barrier diodes
[AD-A035720] N77-26412

SCIENTIFIC SATELLITES
Mesoscale determination of cloud-top height: Problems and solutions
[AD-A037954] N77-26776

SCINTILLATION COUNTERS
Cesium-137 whole-body content in a normal New Mexico population
[LA-UR-76-2097] N77-26798

SCRUBBERS
Particulate control mobile test units: Second year's operation
[PB-264067/0] N77-26721

SEA ICE
Aerial ice reconnaissance and satellite ice information microfilm file
[AD-A037300] N77-26591
Microwave radiometer theory and measurements of sea ice characteristics
[REPT-S-89] N77-26600

SEA WATER
Generation of internal waves by a moving region of pressures in a sea with a discontinuity layer
[AD-A036887] N77-26788
Experimental study of the diffusion of the shape of a laser light pulse during its propagation in the sea
[AD-A036880] N77-26944
Determination of the light quantum survival parameter from the characteristics of light fields in the sea
[AD-A036879] N77-26953

SEALS [STOPPERS]
Interference seals and connectors for undersea electrical applications
[AD-A036841] N77-26522

SEARCH RADAR
Effect of multipath on the height-finding capabilities of a fixed-reflector radar system. Part 3: Effect of radome
[AD-A037957] N77-26356

SECURITY
Study of vulnerability of electronic communication systems to electronic interception, volume 1
[PB-264447/4] N77-26367
Study of vulnerability of electronic communication systems to electronic interception, volume 2
[PB-264448/2] N77-26368
Privacy and security issues in information systems
[AD-A037896] N77-27032

SEDIMENTS
Simulation of cold cloud precipitation in a three-dimensional mesoscale model
[PB-265265] N77-26786
Radiographic analysis of sedimentary structures and depositional histories in Apollo 15 cores
[NASA-CR-153265] N77-27052

SEISMIC WAVES
Cavity detection by means of seismic shear and compressional wave refraction techniques
[TID-27225] N77-26733
Seismic detection of subterranean cavities
[AD-A035711] N77-26744
Evaluation of the Korean short-period array
[AD-A035587] N77-26746

SEISMOGRAMS
Computer programs for seismology: Special applications to the high-gain long-period seismic network
[AD-A037963] N77-26751

SEISMOGRAPHS
Evaluation of the Korean short-period array
[AD-A035587] N77-26746

SEMANTICS
Speech understanding systems. Volume 4: Syntax and semantics
[AD-A035277] N77-26362

SEMICONDUCTING FILMS
Thin films
[BNL-21964] N77-26997

SEMICONDUCTOR DEVICES
Research in materials science
[AD-A037760] N77-26413
Surface study of semiconductor devices
[AD-A037502] N77-26990
Electronic structure of metals and semiconductors: Bulk, surface, and interface properties
[LBL-5493] N77-26992
Electron microscope study of defects in annealed boron implanted silicon
[AD-A037956] N77-27006

SEMICONDUCTORS [MATERIALS]
International Conference on Radiation Effects in Semiconductors
[AD-A036994] N77-26936
Ion implantation in compound semiconductors
[AD-A037958] N77-27010
Symposium on the structure of non-crystalline materials
[AD-A037948] N77-27012

SEPARATED FLOW
Advancement of a method for calculating separated flows around airfoils with special consideration of profile drag
[ESA-TT-373] N77-26091

SEPARATION
Magnetic fluid density separation system
[AD-A035639] N77-26256

SEQUENTIAL ANALYSIS
Establishment of linear sequences
[BLL-RTS-10323] N77-26903

SERVOCONTROL
The concept of antenna servocontrol --- radio interferometer for satellite orbit determination
N77-26206

SHEAR CREEP
Use of state variables in the description of irradiation creep and deformation of metals
[COO-2172-14] N77-26275

SHEAR FLOW
Fine scale structure of turbulent velocity fields
[AD-A035738] N77-26450
Transition in a boundary layer and in a pipe flow
[AD-A037664] N77-26453

SHEAR STRENGTH
Lap shear strength of selected adhesives [epoxy, varnish, B-stage glass cloth] in liquid nitrogen and at room tenperature
[ORNL/TM-5658] N77-26312
Approximate method for strength analysis of circular axially symmetric plates of variable thickness, with ribs on one side and subject to an axially symmetric load
[BLL-RTS-10426] N77-26531

SHEAR STRESS
An experimental method to produce uniform plane stress states with application to fiber reinforced materials
[AD-A037979] N77-26244
Fine scale structure of turbulent velocity fields
[AD-A035738] N77-26450

SHEARING
Multiple-actuator shaker digital control system
[UCRL-78340] N77-26543

SHELLS [STRUCTURAL FORMS]
Dynamic stabilization of the Rayleigh-Taylor instability on laser-imploded shells
[AD-A035605] N77-26505
Numerical analysis of the dynamic response of elasto-plastic shells
[AD-A035965] N77-26537

SHIP HULLS
Experimental investigation of hydrodynamic coefficients of a small-waterplane area, twin-hull model
[AD-A035908] N77-26338

SHIPS
Buckling analysis of ship plate-structures --- using NASTRAN program
[REPT-207-S] N77-26547

SHOCK TESTS
An improved method of determining shock test specifications for fire control equipment
[AD-A037618] N77-26538

SHOCK TUBES
Wave motion in low-pressure-ratio rectangular and pyramidal shock tubes
[UTIAS-199] N77-26421

SHOCK WAVES
Evaluation of the Harpoon missile shock environment during ejection launch by aircraft launchers
[AD-A037067] N77-26186

SHORELINES
Development and application of operational techniques for the inventory and monitoring of resources and uses for the Texas coastal zone
[E77-10174] N77-26576

SIDE-LOOKING RADAR
Performance of coherent-on-receive synthetic aperture side looking airborne radar --- for oil slick detection
[AD-A035032] N77-26366

SIGNAL DISTORTION
Effects of antenna elevation and inclination on VLF/LF signal structure
[AD-A035510] N77-26365

SIGNAL PROCESSING
System definition and investigation of the on site processing of en route sensor signals. Volume 1: Summary of results, system definition, radar processing
[AD-A038491/7] N77-26115
System definition and investigation of the on site processing of en route sensor signals. Volume 2: Beacon processing investigation
[AD-A038492/5] N77-26116
System definition and investigation of the on site processing of en route sensor signals. Volume 3: Appendices
[AD-A038493/3] N77-26117
Principles and applications of adaptive filters: A tutorial review
[AD-A037755] N77-26357
Speech understanding systems. Volume 1: Introduction and overview
[AD-A035165] N77-26359
Speech understanding systems. Volume 2: Acoustic front end
[AD-A035166] N77-26360
Speech understanding systems. Volume 3: Lexicon, lexical retrieval and control
[AD-A035167] N77-26361
Speech understanding systems. Volume 4: Syntax and semantics
[AD-A035277] N77-26362
Speech understanding systems. Volume 5: Trip
[AD-A035278] N77-26363
Space/time random processes and optimum array processing
[AD-A035593] N77-26379
Three phase full wave dc motor decoder
[NASA-CASE-GSC-11824-1] N77-26386
Likelihood ratios for time-continuous data models: The white noise approach
[AD-A037764] N77-26887

SIGNAL TO NOISE RATIOS
Excess noise in selected field-effect transistors
[LBL-5567] N77-26394

SIGNAL TRANSMISSION
Measurement of long-term phase jitter in stuffing multiplex systems for PCM and data signals
[BLL-PO-TRANS-3407-[9022.81]]
N77-26343
The effects of periodic cable defects upon the transmission of wideband signals
[BLL-TRANS-3433-[9022.81]] N77-26344

SILANES
Fluorodinitro silicon compounds. Part 1: Organosilicon and silicate esters of 2,2,2-fluorodinitroethanol. Part 2: Nonhydrolyzable silanes
[AD-A037464] N77-26335

SILICATES
Casting titanium and zirconium in zircon sand molds
[PB-264253/6] N77-26292

SILICON
Effect of atmospheric parameters on silicon cell performance
[NASA-CP-2010] N77-26619
Temperature dependence of the photovoltaic performance of Si cells under blue, white, and near-bandgap irradiation
[UCRL-76203] N77-26652
Electron microscope study of defects in annealed boron implanted silicon
[AD-A037956] N77-27006
Investigation of defects and impurities in silicon-on-sapphire
[AD-A037753] N77-27011

SILICON ALLOYS
The phase composition of alloys of the system Cr-Si-C
[BLL-M-25504-[5828.4F]] N77-26268

SILICON COMPOUNDS
Fluorodinitro silicon compounds. Part 1: Organosilicon and silicate esters of 2,2,2-fluorodinitroethanol. Part 2: Nonhydrolyzable silanes
[AD-A037464] N77-26335

SILVER ZINC BATTERIES
Report for BA 494/U
[AD-A035722] N77-26700

SIMULATORS
Multiplex simulator design study
[AD-A037226] N77-26853
SINE WAVES
Electro-mechanical sine/cosine generator
[NASA-CASE-LAR-11389-1] N77-26387
Trade-off investigations and detailed design of power inverters
[AD-A036027] N77-26407
SINGLE CRYSTALS
The coplanar electron tube
[AD-A037138] N77-26391
Growth of pure single crystals of alkali halides and alkaline earth fluoride
[AD-A037795] N77-27014
SINGULARITY [MATHEMATICS]
The singularity expansion representation of the transient electromagnetic coupling through a rectangular aperture
[AD-A036999] N77-26374
The singularity expansion representation of the transient electromagnetic coupling through a rectangular aperture
[AD-A037353] N77-26375
SINTERING
The effects of sintering parameters and particle size distribution on P/M steel forgings
[AD-A036983] N77-26303
SKIDDING
Effects of pavement grooving on friction, braking, and vehicle control
[PB-264665/1] N77-26560
SKIN [ANATOMY]
Low-temperature handwear with improved dexterity
[AD-A037535] N77-26811
SKYHOOK BALLOONS
Skyhook 1976
[AD-A037419] N77-26094
SKYLAB PROGRAM
Skylab S191, S192 program descriptions — earth radiation data analysis
[NASA-CR-152508] N77-26177
SLIDING FRICTION
Analysis of the friction behavior at high sliding velocities and pressure for gilding metal, annealed iron, copper and projectile steel
[AD-A035674] N77-26521
SLOPES
Effects of antenna elevation and inclination on VLF/LF signal structure
[AD-A035510] N77-26365
SMOKE ABATEMENT
Development of smoke abated aircraft crash/rescue fire fighting trainer
[AD-A035999] N77-26260
SMS 2
Solar-geophysical data number 389. Part 1: Prompt reports. Data for December 1976 - November 1976
[PB-264790/7] N77-27060
SODIUM ALLOYS
Experimental two-phase liquid-metal magnetohydrodynamic generator program
[AD-A035245] N77-26988
SODIUM HYDROXIDES
Environmental considerations of selected energy conserving manufacturing process options. Volume 12: Chlor-alkali industry report
[PB-264278/3] N77-26689
SODIUM IODIDES
Low background Ge[Li] detector with anticoincidence NaI annulus [revised] — for soil samples
[EGG-1183-2326-REV] N77-26463
SOIL EROSION
Land development in the Daly Basin
[E77-10155] N77-26570
SOIL MOISTURE
Results of UHF radiometric and direct ground measurements of soil moisture in 1975
[NASA-TT-F-17521] N77-26726
SOILS
Low background Ge[Li] detector with anticoincidence NaI annulus [revised] — for soil samples
[EGG-1183-2326-REV] N77-26463
Comprehensive study of Leon-Queretaro area — Mexico
[E77-10154] N77-26569
Selective enrichment and isolation of microorganisms on ethyl S-diisopropyl aminoethyl methylphosphonthioate [VX]
[CL-1975-27] N77-26793
SOLAR ACTIVITY
Solar-geophysical data number 389. Part 2: Comprehensive reports. Data for July 1976 - June 1976 and miscellanea
[PB-264791/5] N77-27059
Solar-geophysical data number 389. Part 1: Prompt reports. Data for December 1976 - November 1976
[PB-264790/7] N77-27060
SOLAR ARRAYS
Solar array maximum power tracking with closed-loop control of a 30-centimeter ion thruster
[NASA-TM-X-73643] N77-26222
OTEC annual report to the Division of Solar Energy for FY-1976 and the transition quarter
[BNWL-2154] N77-26665
Research and development of low cost processes for integrated solar arrays
[COO-2721-76-1] N77-26670
SOLAR CELLS
Preliminary results of accelerated exposure testing of solar cell system components
[NASA-TM-X-73674] N77-26615
Test facility for solar-cell reference conditions
[NASA-CP-2010] N77-26618
Effect of atmospheric parameters on silicon cell performance
[NASA-CP-2010] N77-26619
Errors in short circuit measurements due to spectral mismatch between sunlight and solar simulators
[NASA-CR-2010] N77-26620
Consideration of design and calibration of terrestrial reference solar cells
[NASA-CP-2010] N77-26621
Sensitivity of solar-cell performance to atmospheric variables. 1: Single cell
[NASA-CP-2010] N77-26623
Sensitivity of solar-cell performance to atmospheric variables. 2: Dissimilar cells at several locations
[NASA-CP-2010] N77-26624
Introduction to basic solar cell measurements
[NASA-CP-2010] N77-26625
Indoor and outdoor measurements of performance of photovoltaic arrays
[NASA-CP-2010] N77-26626
Silicon solar cell development for concentrated-sunlight, high-temperature applications
[SAND-76-5311] N77-26647
Effects of spectral variations on silicon cell output
[SAND-76-9142] N77-26653
OTEC annual report to the Division of Solar Energy for FY-1976 and the transition quarter
[BNWL-2154] N77-26665
Neutron transmutation doped silicon solar cells
[CONF-761130-2] N77-26671
Effects of outdoor exposure on solar cell modules in the ERDA/NASA Lewis Research Center Systems Test Facility
[NASA-TM-X-73657] N77-26678
SOLAR COLLECTORS
Assembly and testing of a 1.8 by 3.7 meter Fresnel lens solar concentrator
[NASA-CR-150300] N77-26610
Evaluation of initial collector field performance at the Langley Solar Building Test Facility
[NASA-TM-X-73677] N77-26617
Analysis of thermal performance of Solaris water-trickle solar collector
[CONF-761107-17] N77-26668
Evaluation of Solaris water-trickle solar collector and demonstration of annual cycle collection and storage of solar heated water
[CONF-761143-1] N77-26669
Study of corrosion and its control in aluminum solar collectors
[COO-2934-76-1] N77-26673
Calculation of monthly average insolation on tilted surfaces
[CONF-760842-15] N77-27057
SOLAR COOLING
General Electric Company survey to define impact of statewide building codes on solar HVAC systems, commercial buildings. National Solar Demonstration Program
[COO-2683-76-11] N77-26674
SOLAR CORONA
On three-dimensional reconstruction of optically thin solar emission sources
[NASA-TM-X-71341] N77-27056
SOLAR CORPUSCULAR RADIATION
Report on the Brookhaven solar neutrino experiment
[BNL-21837] N77-27058
SOLAR ENERGY
Investigation of possibilities for solar powered high energy lasers in space
[NASA-CR-153271] N77-26478
Hydration-dehydration cycling of MgO-Mg[OH]2 for application to solar heat storage systems
[AI-ERDA-13178] N77-26654
Calculation of monthly average insolation on tilted surfaces
[CONF-760842-15] N77-27057
SOLAR ENERGY CONVERSION
Solar heating and cooling technical data and systems analysis
[NASA-CR-150305] N77-26611
New energy conservation ideas for existing and new buildings
[CONF-750942-2] N77-26660
OTEC annual report to the Division of Solar Energy for FY-1976 and the transition quarter
[BNWL-2154] N77-26665
SOLAR GENERATORS
Assembly and testing of a 1.8 by 3.7 meter Fresnel lens solar concentrator
[NASA-CR-150300] N77-26610
SOLAR HEATING
Evaluation of initial collector field performance at the Langley Solar Building Test Facility
[NASA-TM-X-73677] N77-26617
Solar dwelling design concepts
[HUD-PDR-156[2]] N77-26639
General Electric Company survey to define impact of statewide building codes on solar HVAC systems, commercial buildings. National Solar Demonstration Program
[COO-2683-76-11] N77-26674
Comparative performance of solar heating with air liquid systems
[COO-2868-1] N77-26676
SOLAR POSITION
Specular reflection timing predictions for the period preceding the 1977 vernal equinox
[AD-A036982] N77-26188
SOLAR RADIATION
Calculation of monthly average insolation on tilted surfaces
[CONF-760842-15] N77-27057
SOLAR SIMULATORS
Errors in short circuit measurements due to spectral mismatch between sunlight and solar simulators
[NASA-CR-2010] N77-26620
SOLAR SPECTRA
On three-dimensional reconstruction of optically thin solar emission sources
[NASA-TM-X-71341] N77-27056
SOLID PROPELLANT ROCKET ENGINES
Project DAME: Tactical instrumented missile simulation testing
[AD-A035600] N77-26192
Air Launch Instrumented Vehicles Evaluation [ALIVE] — aging characteristics
[AD-A037102] N77-26237
SOLID PROPELLANTS
Inorganic halogen oxidizer research
[AD-A037421] N77-26259
Explosive tests for establishing hazard classification for M1 SP propellant in automated single-base finishing operations
[AD-A037383] N77-26336
SOLID ROCKET PROPELLANTS
Air Launch Instrumented Vehicles Evaluation [ALIVE] — aging characteristics
[AD-A037102] N77-26237
Literature survey on toxicologic implications of manipulating some solid rocket propellants
[MBL-1976-12] N77-26326
Gasification and ignition of a condensed fuel by a hot stagnant gas
[AD-A037976] N77-26334
SOLID STATE
The electronic structure of crystalline solids: Their surfaces and interfaces
[AD-A037797] N77-27008
SOLID STATE PHYSICS
Electronic energy levels in imperfect solids
[AD-A035723] N77-27017
SOLIDS
Use of graphics in three dimensional structural analysis of solids
[SAND-76-9188] N77-26815
SOLUTIONS
Theory and applications of electron transfers at electrodes and in solution
[AD-A037362] N77-26258
SOS [SEMICONDUCTORS]
Low temperature pressure-oxidation of silicon for integrated circuit technology
[AD-A035266] N77-26405
Planar CMOS/SOS array development
[AD-A037752] N77-27009
SOUND WAVES
Aeolian tones from circular cylinders of non-uniform cross section
[AD-A035994] N77-26923
SOUNDING ROCKETS
Design, construction, test and field support of a containerless payload package for rocket flight — electromagnetic heating and confinement
[NASA-CR-149997] N77-26184
Trajectory determination and telemetry receiving system evaluation
[AD-A037959] N77-26216
SPACE PERCEPTION
Flight test evaluation of Slant Visual Range/Approach Light Contact Height [SVR/ALCH] measurement system
[AD-A038183/0] N77-26113
SPACE PROCESSING
Space processing of chalcogenide glass
[NASA-CR-150311] N77-26176
Design, construction, test and field support of a containerless payload package for rocket flight — electromagnetic heating and confinement
[NASA-CR-149997] N77-26184
SPACE SHUTTLE ORBITERS
Investigation of real-gas and viscous effects on the aerodynamic characteristics of a 40 deg half-cone with suggested correlations for the shuttle orbiter
[NASA-TN-D-8418] N77-26081

Updated dispersion analysis for the first Orbital Flight Test [OFT-1] mission
[NASA-CR-151434] N77-26174
SPACE SHUTTLES
Euler angles, quaternions, and transformation matrices for space shuttle analysis
[NASA-CR-151435] N77-26175
Orbit transfer systems with emphasis on shuttle applications, 1986-1991
[NASA-TM-X-73394] N77-26198
Assessment of relative velocity as independent variable for space shuttle first stage guidance attitude command tables
[NASA-CR-151436] N77-26199
Space shuttle response to acoustic combustion instability in the solid rocket boosters
[AD-A037157] N77-26200
Hardware simulation of KU-band spacecraft receiver and bit synchronizer, phase 2, volume 1 --- for space shuttle
[NASA-CR-151439] N77-26348
Advanced Sensors and Applications Study [ASAS]
[NASA-CR-151441] N77-26590
Atmospheric Cloud Physics Laboratory [ACPL] optical motion control study
[AD-A037250] N77-26741
Design study of the accessible focal plane telescope for shuttle
[NASA-CR-151440] N77-26943
SPACE SURVEILLANCE [GROUND BASED]
Space surveillance software support. Volume 1, part 1, book 3: Computer program documentation
[AD-A033658] N77-26217
SPACE TRANSPORTATION
AGARD highlights 77/1 — research and development economics, policies, and the space transportation system
N77-26074
Orbit transfer systems with emphasis on shuttle applications, 1986-1991
[NASA-TM-X-73394] N77-26198
SPACEBORNE PHOTOGRAPHY
Estimated winter wheat yield from crop growth predicted by LANDSAT
[NASA-CR-151431] N77-26580
SPACEBORNE TELESCOPES
An evaluation of reaction wheel emitted vibrations for space telescope
[NASA-CR-150303] N77-26181
Design study of the accessible focal plane telescope for shuttle
[NASA-CR-151440] N77-26943
SPACECRAFT CABIN SIMULATORS
Remote manipulator system steering capability for SVDS
[NASA-CR-151438] N77-26804
SPACECRAFT CHARGING
Electrostatic changing and discharge phenomena observed in geosynchronous orbit. A bibliography
[ONERA-DERTS-NT-03-11] N77-26388
SPACECRAFT COMMUNICATION
Hardware simulation of KU-band spacecraft receiver and bit synchronizer, phase 2, volume 1 --- for space shuttle
[NASA-CR-151439] N77-26348
SPACECRAFT GUIDANCE
Assessment of relative velocity as independent variable for space shuttle first stage guidance attitude command tables
[NASA-CR-151436] N77-26199
SPACECRAFT MODELS
Results of phase change paint heat transfer test utilizing 0.040-scale 50% forebody models [no. 82-0] of the Rockwell International Space Shuttle Orbiter in AEDC VKF hypersonic tunnel B [test OH54B]
[NASA-CR-151074] N77-26197
SPACECRAFT PERFORMANCE
LANDSAT-1 and LANDSAT-2 flight evaluation report
[NASA-CR-152475] N77-26594
SPACECRAFT POWER SUPPLIES
Supplement ERDA BIPS preliminary design review
[TID-27270] N77-26667
SPACECRAFT PROPULSION
Orbit transfer systems with emphasis on shuttle applications, 1986-1991
[NASA-TM-X-73394] N77-26198
Calculation of underexpanded jets issuing from supersonic nozzles --- noting position of jet boundary and application to hydrazine spacecraft propulsion engines
[REPT-75-4] N77-26438
Investigation of beamed energy concepts for propulsion. Volume 1: Systems studies
[AD-A034995] N77-26491
Investigation of beamed energy concepts for propulsion. Volume 2: Laser/propellant coupling analyses
[AD-A035061] N77-26492
SPACELAB
Avionics evaluation program: Multiple aircraft, multiple sorties and cost accumulation
[AD-A037195] N77-26133
Study on the feasibility of structural thermal canister for the instrument pointing sub-system of the Spacelab, volume 1
[ESA-CR[P]-922-VOL-1] N77-26219
Study on the feasibility of structural thermal canister for the instrument pointing sub-system of the Spacelab, volume 2
[ESA-CR[P]-922-VOL-2] N77-26220
Multidisciplinary lidar system in Spacelab for application to atmospheric physics and remote sensing --- aerosols and trace gases
[BMFT-FB-W-76-23] N77-26597
Design study of the accessible focal plane telescope for shuttle
[NASA-CR-151440] N77-26943
SPARE PARTS
SPAERS: Simulation for the Performance Aircraft Engine Repair Systems
[AD-A035737] N77-26073
SPARROW MISSILES
Project DAME: Tactical instrumented missile simulation testing
[AD-A035600] N77-26192
SPATIAL DISTRIBUTION
An extended set of cosmic ray variational coefficients for European cosmic ray stations
[AD-A036992] N77-27062
SPECIFIC HEAT
Low temperature heat capacity of scandium and scandium alloys
[IS-M-72] N77-26285
SPECIFICATIONS
NASA software specification and evaluation system: Software verification/validation techniques
[NASA-CR-150299] N77-26828
SPECTRAL ENERGY DISTRIBUTION
Effects of spectral variations on silicon cell output
[SAND-76-9142] N77-26653
An extended set of cosmic ray variational coefficients for European cosmic ray stations
[AD-A036992] N77-27062
SPECTRAL LINE WIDTH
Measurement of the widths of emission lines from laser produced plasmas
[UCRL-78446] N77-26983
SPECTRAL SIGNATURES
Analysis of significance within crop-spectra: A comparison study of different multispectral scanners
[NIWARS-PUBL-30] N77-26596
SPECTROGRAPHS
The development of a parallel-channel spectrographic detector: Applications to Raman scattering
[AD-A037407] N77-26265
The calibration of photographic and spectrographic films
[NASA-CR-152525] N77-26458
SPECTROPHOTOGRAPHY
The calibration of photographic and spectrographic films
[NASA-CR-152525] N77-26458
SPECTROPHOTOMETERS
A method to obtain diffuse reflective measurements from 1.0 to 3.0 micrometers using a Cary 17I spectrophotometer
[AD-A035031] N77-26950
SPECTROPHOTOMETRY
Spectrophotometric determination of boron in cobalt and nickel coatings by use of carminic acid
[AD-A037344] N77-26293
Complex formation in metal dissolution and metal treatment
[AD-A037404] N77-26305
SPECTROSCOPIC TELESCOPES
Characterization and distribution of lunar mare basalt types using remote sensing techniques
[NASA-CR-153267] N77-27051
SPECTROSCOPY
Introduction to and review of beam-foil spectroscopy
[AD-A036984] N77-26263
SPECTRUM ANALYSIS
Effect of atmospheric parameters on silicon cell performance
[NASA-CP-2010] N77-26619
Spectral characteristics of a flicker noise model
[MRL-R-680] N77-26881
Time evolving spectra
[AD-A037151] N77-26893
Spectroscopic investigations of adiabatic compression in a Tokamak
[BLL-CTO-1282-[9091.9F]] N77-26971
SPECULAR REFLECTION
Specular reflection timing predictions for the period preceding the 1977 vernal equinox
[AD-A036982] N77-26188
Techniques for flaw detection in composite material structures
[AD-A036026] N77-26243
SPEECH RECOGNITION
Speech understanding systems. Volume 1: Introduction and overview
[AD-A035165] N77-26359
Speech understanding systems. Volume 2: Acoustic front end
[AD-A035166] N77-26360
Speech understanding systems. Volume 3: Lexicon, lexical retrieval and control
[AD-A035167] N77-26361
Speech understanding systems. Volume 4: Syntax and semantics
[AD-A035277] N77-26362
Speech understanding systems. Volume 5: Trip
[AD-A035278] N77-26363
SPHERES
Research on crystal chemistry studies --- scattering of light by magnetic spheres
[AD-A035478] N77-27001
SPIN DYNAMICS
Influence of power on the spin of light planes
[NASA-TT-F-17447] N77-26152
Exploratory investigation of the incipient spinning characteristics of a typical light general aviation airplane
[NASA-TM-X-73671] N77-26153
SPIN TESTS
Influence of power on the spin of light planes
[NASA-TT-F-17447] N77-26152
SPLINE FUNCTIONS
Cubic splines in clutter modeling
[AD-A036975] N77-26883
Optimal prefiltering for spline reconstruction
[AD-A037504] N77-26891
SPOILERS
Flight test data for light aircraft spoiler roll control systems
[NASA-CR-153291] N77-26122
SPRAY NOZZLES
Numerical solution of the spray equation
[UCID-17361] N77-26517
SPUTTERING
Application of sputter-deposited lamellar composite technology to the development of high temperature turbine blade materials and airfoil fabrication
[AD-A037349] N77-26151
Oxide barriers on a GaAs by neutralized ion beam sputtering
[NASA-CR-152866] N77-27007
SQUARE WAVES
Square wave voltammetry at the dropping mercury electrode, theoretical
[AD-A035970] N77-26389
STABILITY
The stability of a beam subjected to a moving mass
[AD-A037719] N77-26566
STABILITY AUGMENTATION
Present-day role of control and stability augmentation systems and future trends
[MBB-UFE-1182[O]] N77-26155
The need for task oriented control laws
N77-26164
STABILITY DERIVATIVES
Effect of gust modelling on the identification of the longitudinal motion derivatives of an aircraft --- HFB-320 aircraft
[DLR-FB-76-63] N77-26157
STACKS
Fuel cell stacks
[AD-A037586] N77-26641
STAINLESS STEELS
Machine casting of ferrous alloys
[AD-A035715] N77-26273
Correlation of high- and low-cycle fatigue data for Incoloy-800H
[BNL-NUREG-50574] N77-26282
Elevated temperature cyclic deformation of stainless-steel and interaction effects with other modes of deformation
[CONF-760819-16] N77-26284
Complex formation in metal dissolution and metal treatment
[AD-A037404] N77-26305
Estimating heat-to-heat variation from a statistician's point of view
[CONF-761107-5] N77-26435
STANDARDIZATION
Candidate languages evaluation report --- Defense Department requirements
[AD-A037639] N77-26844
Candidate language evaluation and recommendation report --- Defense Department requirements
[AD-A037638] N77-26845
STANDARDS
Adhesive bonded aerospace structures standardized repair handbook
[AD-A035601] N77-26072
STAR TRACKERS
Development study for a high accuracy star sensor. Volume 1: Study and development of an outline concept --- noting camera tubes and CCD
[ESA-CR[P]-923-VOL-1] N77-26945
Development study for a high accuracy star sensor. Volume 2: Detailed investigation of preferred concept --- noting CCD area imaging device
[ESA-CR[P]-923-VOL-2] N77-26946
STATIC ELECTRICITY
Effects of laboratory simulated precipitation static electricity and swept stroke lightning on aircraft windshield subsystems
[AD-A037196] N77-26127

STATIONKEEPING
Improvement of OTS attitude control [during stationkeeping] using a microprocessor
[N-30-472-0] N77-26190
STATISTICAL ANALYSIS
CNESRO, CNSIM-CNSTAT programs for the study of the maintenance and availability of a space system. Volume 1: Problem analysis and program realisation --- simulation and statistics programs for synchronous satellite system
[ESA-TM-174-VOL-1] N77-26841
CNESRO, CNSIM-CNSTAT programs for the study of the maintenance and availability of a space system. Volume 2: User's guide --- simulation and statistics programs for synchronous satellite systems
[ESA-TM-174-VOL-2] N77-26842
Tables of required sample size for pairwise comparisons.
[AD-A035603] N77-26898
Statistical measures, probability densities, and mathematical models for stochastic measurements
[AD-A037483] N77-26900
A study of coverage overlap among fourteen major science and technology abstracting and indexing services
[PB-264559/6] N77-27027
STATISTICAL MECHANICS
Thermodynamics and statistical mechanics of liquid crystals and their solutions
[AD-A037105] N77-27003
STATISTICAL TESTS
Estimating heat-to-heat variation from a statistician's point of view
[CONF-761107-5] N77-26435
STATISTICS
Statistical information on activities in operational hydrology --- networks
[WMO-464] N77-26599
STEAM
Status of the steam-iron program
[CONF-761064-5] N77-26672
STEAM TURBINES
Energy Conversion Alternatives Study [ECAS], Phase 2. Volume 1: Summary and combined gas-stream turbine plant with an integrated low-BTU gasifier
[NASA-CR-134942-VOL-1] N77-26628
Energy Conversion Alternatives Study [ECAS], Phase 2. Volume 2: Summary and combined gas-steam turbine plant using coal derived liquid fuel
[NASA-CR-134942-VOL-2] N77-26629
STEEL STRUCTURES
Effect of lack of penetration on fatigue resistance of high-strength structural steel welds
[AD-A037047] N77-26302
STEELS
Effect of percentage bainite formed at 400 deg C on the fracture toughness properties of as-quenched HY130
[AD-A035948] N77-26291
Nondestructive evaluation of metal fatigue
[AD-A037672] N77-26299
Environmental considerations of selected energy conserving manufacturing process options. Volume 3: Iron and steel industry report
[PB-264269/2] N77-26680
STEERABLE ANTENNAS
Mechanical accuracy of the antenna rotary drive and its testing
N77-26204
Construction details of the interferometer rotary drive
N77-26205
Technical details of the control and drive systems --- radio interferometer antennas
N77-26207
Planning of the interferometer antenna
N77-26208
Antennas and central HF cabling --- radio interferometer for satellite orbit determination
N77-26209
Automatic computer controlled operation of the interferometer installation --- satellite orbit determination
N77-26212
STELLAR ENVELOPES
Spatial heterodyne interferometry of VY Canis Major's, alpha Orionis, alpha Scorpii, and R leonis at 11 microns
N77-27049
STELLAR RADIATION
Spatial heterodyne interferometry of VY Canis Major's, alpha Orionis, alpha Scorpii, and R leonis at 11 microns
N77-27049
OSO-8 X-ray observations of AM Herculis
[NASA-TM-X-71313] N77-27050
STELLARATORS
Equilibrium and MHD stability of a plasma in stellarators with three-dimensional axes
[BLL-RISLEY-TR-1285-[9091.9F]]
N77-26967
Current heating of plasma in the L-2 stellarator
[CONF-761012-29] N77-26979
STOCHASTIC PROCESSES
Interpolation of air pollution: A stochastic approach
[COO-2874-11] N77-26710
Optimal control of a stochastic bilinear system
[OUEL-1156/76] N77-26873
Statistical measures, probability densities, and mathematical models for stochastic measurements
[AD-A037483] N77-26900
Covariance analysis of some nonstationary time series
[AD-A037482] N77-26901
STORAGE BATTERIES
New batteries and their impact on electric vehicles
[NASA-TM-X-73672] N77-26614
Research and development in the glass fiber sodium-sulfur battery
[AD-A037215] N77-26694
Research and development of the glass fiber sodium-sulfur battery
[AD-A037216] N77-26695
STRAIN GAGES
Stress-gage system for the megabar [100GPa] range
[AD-A035583] N77-26459
Calculator controlled strain gage data acquisition system
[SAND-76-0146] N77-26467
A-37B fatigue sensor data analysis methodology program
[AD-A037341] N77-26469
STRAIN RATE
Effects of test temperature, strain rate, and thermal exposure on the tensile properties of Alloy 600
[HEDL-TME-76-62] N77-26281
Evaluating strength and ductility of irradiated Zircaloy. Task 5
[BMI-NUREG-1961] N77-26283
STRAPDOWN INERTIAL GUIDANCE
Flight test results of the Strapdown hexad Inertial Reference Unit [SIRU]. Volume 1: Flight test summary
[NASA-TM-73163] N77-26111
STRATIFIED FLOW
Unsteady flow and flame propagation in a prechamber of a stratified charge engine
[SAND-75-8743] N77-26250
Turbulent wake in a stratified medium
[AD-A036876] N77-26448
STRATOSPHERE
Monte Carlo analysis of uncertainty propagation in a stratospheric model. 2: Uncertainties due to reaction rates
[NASA-TM-X-71339] N77-26349
Aerosol physical properties in the stratosphere [APPS] radiometer design
[NASA-CR-145199] N77-26732
Meteorological data, series B basic material. Volume 3, no. 4: Daily altitude charts of the 50 mb plane and monthly average charts for the year 1975, part 4
[QR-4-PT-4] N77-26769
Meteorological data, series B basic material. Volume 4, no. 3: Daily altitude charts of the 30 mb plane and monthly average charts for the year 1975, part 3
[QR-3-PT-3] N77-26770
Meteorological data, series B basic material. Volume 4, no. 4: Daily altitude charts of the 30 mb plane and monthly average charts for the year 1975, part 4
[QR-4-PT-4] N77-26771
STRESS ANALYSIS
An experimental method to produce uniform plane stress states with application to fiber reinforced materials
[AD-A037979] N77-26244
Computer controlled X-ray stress analysis for inspection of manufactured components
[AD-A037350] N77-26529
Nonlinear analysis of bonded joints with thermal effects
[NASA-CR-153263] N77-26534
Parametric analysis of the stresses in a cruciform axially loaded welded joint
[REPT-76-3] N77-26553
Static and dynamic behavior of noncircular cylindrical shells
[AD-A037673] N77-26562
STRESS CORROSION
Flaw growth of 7075, 7475, 7050 and 7049 aluminum alloy plate in stress corrosion environments
[NASA-CR-150313] N77-26272
The role of solvated electrons in stress corrosion cracking phenomena. Part 1: Conceptual considerations
[AD-A037527] N77-26297
STRESS CORROSION CRACKING
Corrosion, stress corrosion cracking, and electrochemistry of the iron and nickel base alloys in caustic environments
[COO-2421-03] N77-26277
Intergranular stress corrosion cracking of sensitized chrome-nickel steels in boiling water
[ORNL-TR-4272] N77-26287
STRESS-STRAIN DIAGRAMS
Influence of temper condition on the nonlinear stress-strain behavior of boron-aluminum
[NASA-TM-X-74753] N77-26271
STRUCTURAL ANALYSIS
Buckling analysis of ship plate-structures --- using NASTRAN program
[REPT-207-S] N77-26547
Structural analysis of a wing part using the ASKA program system --- F-28 aircraft
[NLR-TR-73030-U] N77-26549
The analysis of reinforced holes in carbon fibre plates
N77-26556
Reliability study of SINGER. Volume 1: Validation of model
[AD-A037819] N77-26561
Application of hybrid finite elements to structure mechanics problems
[AD-A038016] N77-26563
Use of graphics in three dimensional structural analysis of solids
[SAND-76-9188] N77-26815
STRUCTURAL BASINS
Land development in the Daly Basin
[E77-10155] N77-26570
Land development in the Daly Basin
[E77-10156] N77-26571
STRUCTURAL DESIGN
Research requirements for development of improved helicopter rotor efficiency
[NASA-CR-145117] N77-26121
Optimization of the characteristics of structural reinforced plastics. Part I: General theory
[CRIF-PL-10] N77-26315
First report on capabilities of dynamic structural analysis by the STRUDL program --- exemplified for frame analysis
[REPT-76-2] N77-26551
Solar dwelling design concepts
[HUD-PDR-156[2]] N77-26639
STRUCTURAL DESIGN CRITERIA
Optimum design of composite wing structures with twist constraint for aeroelastic tailoring
[AD-A038029] N77-26099
Design curves for structural response due to impact loading
[AD-A037011] N77-26513
Consideration of design and calibration of terrestrial reference solar cells
[NASA-CP-2010] N77-26621
Particulate control mobile test units: Second year's operation
[PB-264067/0] N77-26721
STRUCTURAL ENGINEERING
Composite sandwich lattice structure
[NASA-CASE-LAR-11898-2] N77-26242
STRUCTURAL MEMBERS
Reliability study of SINGER. Volume 1: Validation of model
[AD-A037819] N77-26561
Transient response of continuous elastic structures
[AD-A037001] N77-26565
STRUCTURAL PROPERTIES [GEOLOGY]
Application of standard photogeologic techniques to LANDSAT imagery for mineral exploration in the basin and range province of Utah and Nevada
[E77-10170] N77-26572
Resurvey of site stability quadrilaterals, Otay Mountain and Quincy, California --- San Andreas fault experiment
[NASA-CR-149155] N77-26728
STRUCTURAL STABILITY
Comparative performance of structural layers in pavement systems. Volume 4: Analysis of insulating layers in pavement test sections
[AD-A038116/0] N77-26168
Approximate method for strength analysis of circular axially symmetric plates of variable thickness, with ribs on one side and subject to an axially symmetric load
[BLL-RTS-10426] N77-26531
Transient response of continuous elastic structures
[AD-A037001] N77-26565
STRUCTURAL VIBRATION
Treatment of the nonlinear vibration of a variable sweep aircraft wing with its drive using a simplified wing model
[MBB-UFE-1191[O]] N77-26156
Measurement of long-term phase jitter in staffing multiplex systems for PCM and data signals
[BLL-PO-TRANS-3407-[9022.81]]
N77-26343
Simulation of sub-span galloping of bundled conductors: A simplified model
[BLL-CE-TRANS-7067-[9022.09]]
N77-26417
Laboratory verification of force determination, a potential tool for reliability testing
[AD-A035960] N77-26523
STRUCTURAL WEIGHT
Parametric study of transport aircraft systems cost and weight
[NASA-CR-151970] N77-26106

SUBSONIC SPEED
Estimation at subsonic speeds of the longitudinal and lateral aerodynamic characteristics of wing-body combinations at angles up to 90 deg
[WRE-REPT-1672[WR/D]] N77-26080
SUGAR BEETS
Systems study of fuels from sugarcane, sweet sorghum, sugar beets, and corn
[TID-27336] N77-26324
SUGAR CANE
Systems study of fuels from sugarcane, sweet sorghum, sugar beets, and corn
[TID-27336] N77-26324
SULFATES
Comparison of wet chemical and instrumental methods for measuring airborne sulfate
[PB-264201/5] N77-26719
SULFIDES
Resonant Raman scattering in GaSe and GaS[x]Se[1-x]
[LBL-5456] N77-26993
Evaluation of sulfosalts
[AD-A037946] N77-27015
SULFONIC ACID
New materials for fluorosulfonic acid electrolyte fuel cells
[AD-A036988] N77-26640
SULFUR COMPOUNDS
Optical properties of layer compounds Ga s sub x Se sub 1-x
[LBL-5464] N77-26994
SULFUR DIOXIDES
Improvements to single-source model. Volume 1: Time-concentration relationships
[PB-264686/7] N77-26720
SULFUR OXIDES
Oxidation of sulfur dioxide in power plant plumes
[BNL-21698] N77-26713
SUNLIGHT
Errors in short circuit measurements due to spectral mismatch between sunlight and solar simulators
[NASA-CR-2010] N77-26620
Some basic considerations of measurements involving collimated direct sunlight
[NASA-CP-2010] N77-26622
Silicon solar cell development for concentrated-sunlight, high-temperature applications
[SAND-76-5311] N77-26647
Results from circumsolar radiation measurements
[LBL-5292] N77-26657
SUPERCONDUCTING MAGNETS
Superconducting energy storage development for electric utility systems
[LA-UR-76-2294] N77-26649
SUPERCONDUCTING POWER TRANSMISSION
Comparative cost study of the processes for producing niobium-tin [Nb3 Sn] superconducting tapes for their application to power transmission lines
[ERDA-76-160] N77-26999
SUPERCONDUCTIVITY
Cryogenic instrumentation — superconducting devices and materials
[AD-A037133] N77-26476
SUPERCONDUCTORS
Cryogenic instrumentation — superconducting devices and materials
[AD-A037133] N77-26476
Research and development efforts relative to superconducting materials
[CONS/2551-1] N77-26998
SUPERCRITICAL WINGS
An exact hodograph method for the design of supercritical airfoils
[MBB-UFE-1168[O]] N77-26124
SUPERHIGH FREQUENCIES
Hardware simulation of KU-band spacecraft receiver and bit synchronizer, phase 2, volume 1 — for space shuttle
[NASA-CR-151439] N77-26348
Development of a klystron for satellite operation in the 12 GHz frequency band
[BMFT-FB-W-76-24] N77-26358
X-band power FET development
[AD-A035642] N77-26410
SUPERSONIC AIRCRAFT
Low speed wind tunnel tests of 1/10-scale model of a blended-arrow supersonic cruise aircraft
[NASA-TN-D-8410] N77-26069
Low-speed wind tunnel tests of 1/9-scale model of a variable-sweep supersonic cruise aircraft — conducted in the Langley full-scale wind tunnel
[NASA-TN-D-8380] N77-26070
Wind tunnel tests of supersonic lifting bodies at Mach number 1.5 to 4.0
[AD-A037380] N77-26097
Boron/aluminum fan blades for SCAR engines
[NASA-CR-135184] N77-26135
Judgements of relative noisiness of a supersonic transport and several commercial-service aircraft
[NASA-TN-D-8434] N77-26702
SUPERSONIC FLOW
The problem of a blunt body in a rarefied supersonic flow
[REPT-75-3] N77-26088
Numerical integration of the governing equations for the domain of pure supersonic flows — at pointed or blunt bodies
[ESA-TT-380] N77-26092
The numerical computations of supersonic flow past blunt bodies
[AD-A037665] N77-26105
A finite difference scheme for the calculation of supersonic three dimensional flow fields around blunt bodies
[ESA-TT-366] N77-26445
An application of the Chapman-Korst theory to supersonic nozzle-afterbody flows
[AD-A035254] N77-26447
SUPERSONIC NOZZLES
Calculation of underexpanded jets issuing from supersonic nozzles — noting position of jet boundary and application to hydrazine spacecraft propulsion engines
[REPT-75-4] N77-26438
An application of the Chapman-Korst theory to supersonic nozzle-afterbody flows
[AD-A035254] N77-26447
SUPERSONIC SPEEDS
Aerodynamic interference of two axisymmetric stores at low supersonic speeds
[AD-A036900] N77-26100
SUPERSONIC TRANSPORTS
Judgements of relative noisiness of a supersonic transport and several commercial-service aircraft
[NASA-TN-D-8434] N77-26702
SUPERSONIC WIND TUNNELS
A computer program for the design of plane and axisymmetric supersonic wind tunnel nozzles
[ESA-TT-367] N77-26170
SUPPRESSORS
Static and wind tunnel near-field/far-field jet noise measurements from model scale single-flow base line and suppressor nozzles. Summary report — conducted in the Boeing large anechoic test chamber and the NASA-Ames 40by 80-foot wind tunnel
[NASA-CR-2841] N77-26140
SURFACE ACOUSTIC WAVE DEVICES
Distributed feedback acoustic surface wave oscillator
[NASA-CASE-NPO-13673-1] N77-26919
Temperature compensated piezoelectric materials
[AD-A037796] N77-27013
SURFACE DEFECTS
Techniques for flaw detection in composite material structures
[AD-A036026] N77-26243
SURFACE FINISHING
Research on coatings or surface treatment of metal powders
[AD-A036870] N77-26298
Impurity control in near-term Tokamak reactors
[CONF-760935-48] N77-26984
SURFACE PROPERTIES
Chemical modification of carbon electrodes
[AD-A036991] N77-26264
The National Measurement System for Surface Properties
[PB-264258/5] N77-26340
Continuous surface-density Monte Carlo solution to the Dirichlet heat-transfer problem
[AD-A037899] N77-26429
Surface study of semiconductor devices
[AD-A037502] N77-26990
Electronic structure of metals and semiconductors: Bulk, surface, and interface properties
[LBL-5493] N77-26992
The electronic structure of crystalline solids: Their surfaces and interfaces
[AD-A037797] N77-27008
SURFACE ROUGHNESS
An experimental study of the atmospheric boundary layer modified by a change in surface roughness and surface temperature
[NASA-CR-141422] N77-26730
SURFACE ROUGHNESS EFFECTS
Results of phase change paint heat transfer test utilizing 0.040-scale 50% forebody models [no. 82-0] of the Rockwell International Space Shuttle Orbiter in AEDC VKF hypersonic tunnel B [test OH54B]
[NASA-CR-151074] N77-26197
SURFACE TEMPERATURE
An experimental study of the atmospheric boundary layer modified by a change in surface roughness and surface temperature
[NASA-CR-141422] N77-26730
SURFACE TO SURFACE MISSILES
The 12817A Lance Missile number 2241, round 292 number ECL, 20 October 1976
[AD-A037935] N77-26764
SURFACE WATER
Water resources data for California, 1975. Volume 1: Colorado River basin, southern great basin from Mexican border to Mono Lake Basin, and Pacific slope basins from Tijuana River to Santa Maria River
[PB-264474/8] N77-26602
Water resources data for California, 1975. Volume 2: Pacific slope basins from Arroyo Grande to Oregon State line except Central Valley
[PB-264475/5] N77-26603
SURFACE WAVES
Solution of transient problems in free surface hydrodynamics
[AD-A037717] N77-26452
SURGES
The singularity expansion representation of the transient electromagnetic coupling through a rectangular aperture
[AD-A036999] N77-26374
The singularity expansion representation of the transient electromagnetic coupling through a rectangular aperture
[AD-A037353] N77-26375
Solution of transient problems in free surface hydrodynamics
[AD-A037717] N77-26452
SURVEILLANCE RADAR
System definition and investigation of the on site processing of en route sensor signals. Volume 1: Summary of results, system definition, radar processing
[AD-A038491/7] N77-26115
System definition and investigation of the on site processing of en route sensor signals. Volume 2: Beacon processing investigation
[AD-A038492/5] N77-26116
System definition and investigation of the on site processing of en route sensor signals. Volume 3: Appendices
[AD-A038493/3] N77-26117
SWITCHING
Functioning of power rectifiers and thyristors — forward characteristics, shorted emitter, switching response, and reverse capability
[ESA-TT-389] N77-26402
SWITCHING CIRCUITS
Analysis of the ARPA satellite circuit between Etam, W. Va., and Goonhilly, UK and proposed improvements to the circuit design
[AD-A037675] N77-26194
SWITCHING THEORY
Communications processor system, volume 1, 2, and 3
[AD-A036873] N77-26370
Communications processor system, volume 8
[AD-A036874] N77-26371
Communications processor system
[AD-A037159] N77-26372
SYNCHRONOUS SATELLITES
CNESRO, CNSIM-CNSTAT programs for the study of the maintenance and availability of a space system. Volume 1: Problem analysis and program realisation — simulation and statistics programs for synchronous satellite system
[ESA-TM-174-VOL-1] N77-26841
CNESRO, CNSIM-CNSTAT programs for the study of the maintenance and availability of a space system. Volume 2: User's guide — simulation and statistics programs for synchronous satellite systems
[ESA-TM-174-VOL-2] N77-26842
SYNOPTIC METEOROLOGY
Forecast guides used for the centralized terminal forecast program
[AD-A035651] N77-26760
SYNTAX
Speech understanding systems. Volume 4: Syntax and semantics
[AD-A035277] N77-26362
SYNTHETIC ARRAYS
Digital reconstruction of a coded image obtained with a nonredundant pinhole array
[LA-UR-76-1789] N77-26464
SYNTHETIC FUELS
International Conference on Hydrogen and its Prospects
[AD-A036936] N77-26696
SYSTEM EFFECTIVENESS
On-orbit performance of the 12 GHz, 200 watt transmitter experiment package for CTS
[NASA-TM-X-73636] N77-26183
SYSTEMS ANALYSIS
Model structure determination and test input selection for identification of nonlinear regimes
[AD-A037831] N77-26131
Systems theory of the radio interferometer
N77-26203
A practical guide to reliability
[AD-A037611] N77-26524
Evaluation of Solaris water-trickle solar collector and demonstration of annual cycle collection and storage of solar heated water
[CONF-761143-1] N77-26669
Comparative performance of solar heating with air liquid systems
[COO-2868-1] N77-26676
A-6E systems approach to training, phase 1
[AD-A037468] N77-26803
Human factors programs in Navy systems acquisition
[AD-A037775] N77-26807
Computer-aided analysis of circuits and systems — workshop held 24 Jan. 1977
[ESA-SP-123] N77-26904
Overall view of computer-aided analysis at ESTEC
N77-26905

Information, consistent estimation and dynamic system identification
[AD-A037972] N77-26913
SYSTEMS ENGINEERING
Computer programs for tethered-balloon system design and performance evaluation
[AD-A035505] N77-26085
Engineering of control systems and implications on control law design
N77-26163
Experimental two-phase liquid-metal magnetohydrodynamic generator program
[AD-A035245] N77-26988

T

TABLES [DATA]
Meteorological data. Volume 142, no. 4: Aerological data, Berlin-Tempelhof, 1974
[QR-4] N77-26767
Solar-geophysical data number 389. Part 2: Comprehensive reports. Data for July 1976 - June 1976 and miscellanea
[PB-264791/5] N77-27059
Solar-geophysical data number 389. Part 1: Prompt reports. Data for December 1976 - November 1976
[PB-264790/7] N77-27060
TANTALUM
Laser-produced X-UV spectra of T6a and W
[AD-A035391] N77-26494
TASK COMPLEXITY
Task-Oriented Flight Control Systems
[AGARD-LS-89] N77-26161
Task-Oriented Flight Control Systems: Introduction and overview --- aircraft control
N77-26162
The need for task oriented control laws
N77-26164
Implementation of task-oriented control laws
N77-26165
Additional degrees of freedom --- and associated task oriented flight control system functions
N77-26166
Bibliography on task-oriented flight control systems
N77-26167
TAYLOR INSTABILITY
Dynamic stabilization of the Rayleigh-Taylor instability on laser-imploded shells
[AD-A035605] N77-26505
TECHNETIUM
Radionuclidic impurities in 99Mo[99m] Tc generators, their measurements and importance
[BLL-RTS-10018] N77-26925
TECHNICAL WRITING
A study of coverage overlap among fourteen major science and technology abstracting and indexing services
[PB-264559/6] N77-27027
A computer storage and retrieval system for scientific data
[AD-A037738] N77-27031
TECHNOLOGICAL FORECASTING
Integrated engine instrument system, volume I
[AD-A035565] N77-26143
TECHNOLOGY ASSESSMENT
A study of commuter air service
[NASA-CR-152005] N77-26108
Aeronautical systems technology needs. Test facilities and test equipment
[AD-A035252] N77-26171
Modification techniques and performance characteristics of hydrogen-powered IC engines: State of the art, 1975
[ANCR-1302] N77-26516
The marine gas turbine: The UK provides a case study in technological development
[AD-A037686] N77-26535
National assessment of the urban particulate problem. Volume 1: Summary of national assessment
[PB-263665/2] N77-26715
National assessment of the urban particulate problem. Volume 2: Particle characterization
[PB-263666/0] N77-26716
Evaluation of the technical and economic feasibility of mirror fusion devices
[UCRL-13695] N77-26977
TECHNOLOGY TRANSFER
Remote sensing program --- Cornell University program
[NASA-CR-153288] N77-26568
Application of remote sensing to state and regional programs
[NASA-CR-153279] N77-26586
Technology transfer: Transportation
[NASA-CR-153272] N77-27034
TECHNOLOGY UTILIZATION
Assessment of the utility/utilization of the Air Force laboratories by the system program organizations
[AD-A037758] N77-27025
Technology transfer: Transportation
[NASA-CR-153272] N77-27034
TELECOMMUNICATION
Local, regional and large scale integrated networks: Volume 1. Large networks for defense communications: Strategies, performance measures and cost trends
[AD-A035949] N77-26350
Local, regional and large scale integrated networks. Volume 2. Recent advances in ground packet radio systems
[AD-A035950] N77-26351
Local, regional and large scale integrated networks. Volume 3. Recent advances in large scale integrated networks
[AD-A035951] N77-26352
Local, regional and large scale integrated networks; Volume 4. Local and regional communication networks - technologies and architectures
[AD-A035952] N77-26353
Local, regional and large scale
[AD-A03593] N77-26354
Study of vulnerability of electronic communication systems to electronic interception, volume 1
[PB-264447/4] N77-26367
Study of vulnerability of electronic communication systems to electronic interception, volume 2
[PB-264448/2] N77-26368
Communications processor system
[AD-A037159] N77-26372
A technical description of the Automated Technical Control [ATEC] system AN/GYM-12-[V]
[AD-A037943] N77-26382
TELEMETRY
Trajectory determination and telemetry receiving system evaluation
[AD-A037959] N77-26216
TELEPHONY
The electret microphone: A new microphone for telephony
[BLL-PO-3384-[9022.81]] N77-26345
TELEVISION SYSTEMS
Prediction of modulation detectability thresholds for line-scan displays
[AD-A035735] N77-26384
TELEVISION TRANSMISSION
Improvement of the picture definition of a television signal of limited frequency bandwidth by linear measures
[BLL-RTS-10578] N77-26342
TELLURIUM
Development of an optical disc recorder --- using tellurium film
[AD-A037832] N77-26473
TEMPER [METALLURGY]
Influence of temper condition on the nonlinear stress-strain behavior of boron-aluminum
[NASA-TM-X-74753] N77-26271
TEMPERATURE
Indoor and outdoor measurements of performance of photovoltaic arrays
[NASA-CP-2010] N77-26626
TEMPERATURE COMPENSATION
Temperature compensated piezoelectric materials
[AD-A037796] N77-27013
TEMPERATURE CONTROL
Study on the feasibility of structural thermal canister for the instrument pointing sub-system of the Spacelab, volume I
[ESA-CR[P]-922-VOL-1] N77-26219
Study on the feasibility of structural thermal canister for the instrument pointing sub-system of the Spacelab, volume 2
[ESA-CR[P]-922-VOL-2] N77-26220
Development and qualification of PCM thermal capacitors. Part 1: Development of a 30 Wh PCM thermal capacitor --- temperature control of electronic components
[BMFT-FB-W-76-26-VOL-1] N77-26436
Development and qualification of PCM thermal capacitors. Part 2: Development of PCM thermal capacitor platforms and PCM thermal capacitor radiators --- satellite temperature control
[BMFT-FB-W-76-27-VOL-2] N77-26437
Comfort range thermal storage
[BNL-21591] N77-26661
TEMPERATURE DISTRIBUTION
Application of the equivalency principle to the solution of heat conductivity problems
[AD-A037584] N77-26428
TEMPERATURE EFFECTS
Stability and thermal effects of field ion emitters
N77-26230
Effect of temperature on the mechanical properties of uranium
[SAND-76-6038] N77-26276
Effects of test temperature, strain rate, and thermal exposure on the tensile properties of Alloy 600
[HEDL-TME-76-62] N77-26281
TENSILE DEFORMATION
Use of state variables in the description of irradiation creep and deformation of metals
[COO-2172-14] N77-26275
Elevated temperature cyclic deformation of stainless-steel and interaction effects with other modes of deformation
[CONF-760819-16] N77-26284
TENSILE PROPERTIES
Effects of test temperature, strain rate, and thermal exposure on the tensile properties of Alloy 600
[HEDL-TME-76-62] N77-26281
TENSILE STRENGTH
A comparison of the effects of specimen thickness and subcritical crack growth on several nonlinear fracture toughness parameters
[AD-A037470] N77-26296
TENSILE TESTS
Evaluating strength and ductility of irradiated Zircaloy. Task 5
[BMI-NUREG-1961] N77-26283
Estimating heat-to-heat variation from a statistician's point of view
[CONF-761107-5] N77-26435
TERMINAL BALLISTICS
Model analysis for penetration of spaced armor
[AD-A035460] N77-26520
TERNARY SYSTEMS
The phase composition of alloys of the system Cr-Si-C
[BLL-M-25504-[5828.4F]] N77-26268
TERRAIN
A technique for measuring optical line of sight
[AD-A037191] N77-26609
TERRESTRIAL RADIATION
Skylab S191, S192 program descriptions --- earth radiation data analysis
[NASA-CR-152508] N77-26177
TEST EQUIPMENT
Modified AN/PSM-13 for field testing BA-4386/PRC-25 --- zinc carbon batteries
[AD-A037002] N77-26180
A technical description of the Automated Technical Control [ATEC] system AN/GYM-12-[V]
[AD-A037943] N77-26382
Forward reasoning and dependency-directed backtracking in a system for computer-aided circuit analysis
[AD-A035719] N77-26411
An improved method of determining shock test specifications for fire control equipment
[AD-A037618] N77-26538
TEST FACILITIES
Aeronautical systems technology needs. Test facilities and test equipment
[AD-A035252] N77-26171
The ESTEC electric propulsion test facility
N77-26225
Recent results of tests of experimental cesium field emitters with the ESTEC electric propulsion test facility
N77-26233
A thermal imaging sensor evaluation facility
[AD-A037411] N77-26470
Test facility for solar-cell reference conditions
[NASA-CP-2010] N77-26618
An approach to low noise axial flow fan design, manufacture and testing
N77-26922
TESTS
Microcomputer controlled, interactive testing terminal development
[AD-A035731] N77-26821
TETHERED BALLOONS
Computer programs for tethered-balloon system design and performance evaluation
[AD-A035505] N77-26085
TEXAS
Development and application of operational techniques for the inventory and monitoring of resources and uses for the Texas coastal zone
[E77-10174] N77-26576
Analytical and experimental assessment of highway impact on air quality
[PB-264590/1] N77-26724
Management assistance for Texas city governments. Volume 1: Appendices A-C
[PB-264866/5] N77-27045
TEXTILES
Environmental considerations of selected energy conserving manufacturing process options. Volume 9: Textile industry report
[PB-264275/9] N77-26686
THALLIUM COMPOUNDS
Evaluation of sulfosalts
[AD-A037946] N77-27015
THEMIS PROJECT
Cryogenic instrumentation --- superconducting devices and materials
[AD-A037133] N77-26476
THEOREM PROVING
Levinson- and Chandrasekhar-type equations for a general, discrete-time linear estimation problem
[AD-A037678] N77-26902
THEOREMS
Concerning the existence of two ferroresonance regimes
[BLL-CE-TRANS-6837-[9022.09]] N77-26915
THEORETICAL PHYSICS
Theoretical research in physics of highly ionized atoms
[COO-2557-1] N77-26931

Lectures on the new particles
[LBL-5500] N77-26939

THERAPY
Oxime therapy and oxime blood levels in rats: Dependence on the dose of the organophosphate
[MBL-1976-7] N77-26791

THERMAL BUCKLING
Exosat thermal distorsions --- finite element structural model
[FOK-RV-76-56] N77-26548

THERMAL CONDUCTIVITY
Thermophysical properties of polystyrene and poly[vinyl chloride]
[PB-265228/7] N77-26267

THERMAL CYCLING TESTS
Correlation of high- and low-cycle fatigue data for Incoloy-800H
[BNL-NUREG-50574] N77-26282

THERMAL DEGRADATION
Thermal degradation studies of fibers and composite base materials
[AD-A037604] N77-26245

THERMAL MAPPING
Thermal imaging systems relative performance: 3-5 micrometers vs 8-12 micrometers
[AD-A037248] N77-26958

THERMAL PLASMAS
Scatha satellite instrumentation report: Thermal plasma analyzer; rapid scan particle detector; electron beam system; positive ion beam system
[AD-A035506] N77-26185

THERMAL RADIATION
Measurement of growth, measurement and bidirectoral scattering parameters of wheat
[NASA-CR-151351] N77-26592
An approach to the short-range prediction of early morning radiation fog
[AD-A037961] N77-26765

THERMAL STABILITY
Effect of naphthols on the thermal stability of fuels
[NASA-TT-F-17302] N77-26322
High stability temperature compensated crystal oscillator study
[AD-A036908] N77-26415
Comfort range thermal storage
[BNL-21591] N77-26661

THERMAL STRESSES
Intrinsic and thermal stress modeling for thin-film multilayers
[AD-A035513] N77-26493
Stresses produced in a long cylinder by a nuclear thermal environment
[AD-A037426] N77-26539

THERMISTORS
A test of the use of thermistor sensors for measuring small rates of water flow
[BLL-RTS-10421] N77-26455

THERMOCHEMICAL PROPERTIES
Thermochemical analyses of the oxidative vaporization of metals and oxides by oxygen molecules and atoms
[NASA-TM-X-73682] N77-26270

THERMOCHEMISTRY
Reliability estimating procedures for electric and thermochemical propulsion systems, volume 1
[AD-A037745] N77-26234
Reliability estimating procedures for electric and thermochemical propulsion systems, volume 2
[AD-A037748] N77-26235

THERMODYNAMIC EQUILIBRIUM
Thermochemical analyses of the oxidative vaporization of metals and oxides by oxygen molecules and atoms
[NASA-TM-X-73682] N77-26270

THERMODYNAMIC PROPERTIES
Analysis of thermal performance of Solaris water-trickle solar collector
[CONF-761107-17] N77-26668
Application of an electron beam to high density flows of N2, O2 and NO
[AD-A037197] N77-26935
Status of laser fusion
[UCRL-77056] N77-26938
Computer programs for the evaluation of activity and osmotic coefficients
[PB-262600/0] N77-27019

THERMODYNAMICS
Temperature dependence of the photovoltaic performance of Si cells under blue, white, and near-bandgap irradiation
[UCRL-76203] N77-26652
Thermodynamics and statistical mechanics of liquid crystals and their solutions
[AD-A037105] N77-27003

THERMONUCLEAR POWER GENERATION
The controlled thermonuclear fusion research programme in the USSR for 1976 - 1977
[BLL-CTO-1296-[9091.9F]] N77-26969

THERMONUCLEAR REACTIONS
Investigation of model thermonuclear systems with liners
[BLL-CTO-1290-[9091.9F]] N77-26968

THERMOPHYSICAL PROPERTIES
Thermophysical properties of polystyrene and poly[vinyl chloride]
[PB-265228/7] N77-26267

THERMOPLASTIC RESINS
Boron trifluoride coatings for thermoplastic materials
[NASA-CASE-ARC-11057-1] N77-26308

THETA PINCH
Strong fast-rising magnetic fields in experiments on heating a dense plasma in a rapid theta pinch
[BLL-CTO-1287-[9091.9F]] N77-26964

THIN FILMS
Research study in growth of aluminum-nitride on sapphire piezoelectric films
[AD-A037793] N77-26307
The electret microphone: A new microphone for telephony
[BLL-PO-3384-[9022.81]] N77-26345
An investigation of basic noise properties of field emission
[AD-A037094] N77-26390
Development of sandwich structured photosensitive films for application to non-contact potentiometers
[AD-A037412] N77-26471
Intrinsic and thermal stress modeling for thin-film multilayers
[AD-A035513] N77-26493
Thin films
[BNL-21964] N77-26997

THIN WALLED SHELLS
The theoretical and experimental dynamic analysis of thin shells of revolution --- using finite element method
N77-26557

THREE DIMENSIONAL COMPOSITES
Techniques of three-dimensional reconstruction
[BNL-20425] N77-26817

THREE DIMENSIONAL FLOW
The influence of boundary point procedures on accuracy and efficiency in flow field calculations
[DOC-77SDR016] N77-26424
Use of graphics in three dimensional structural analysis of solids
[SAND-76-9188] N77-26815
Investigation of plasma confinement in a device with a three-dimensional axis
[BLL-CTO-1286-[9091.9F]] N77-26963

THRESHOLDS
Electrically initiated HCl chemical laser and threshold excitation of XeF and KrF lasers
[AD-A037732] N77-26481

THRESHOLDS [PERCEPTION]
Prediction of modulation detectability thresholds for line-scan displays
[AD-A035735] N77-26384

THRUST CHAMBERS
Advanced thrust chamber technology
[NASA-CR-135221] N77-26221

THRUST CONTROL
Solar array maximum power tracking with closed-loop control of a 30-centimeter ion thruster
[NASA-TM-X-73643] N77-26222

THUNDERSTORMS
Meteorological data, series A monographs. Volume 1, no. 2: Accuracy of locating distant thunderstorm centers with Heinrich Hertz Institute's VLF atmospherics analyzer
N77-26768

THYRISTORS
Functioning of power rectifiers and thyristors --- forward characteristics, shorted emitter, switching response, and reverse capability
[ESA-TT-389] N77-26402

TIME DEPENDENCE
Concept of frequency separation in life prediction for time-dependent fatigue
[CONF-761107-14] N77-26542
An implicit, compact, finite difference method to solve hyperbolic equations
[VKI-TN-119] N77-26885

TIME DIVISION MULTIPLEXING
Measurement of long-term phase jitter in stuffing multiplex systems for PCM and data signals
[BLL-PO-TRANS-3407-[9022.81]] N77-26343

TIME LAG
Evaluation of a correction method for digital computer lag in hybrid systems
[SAND-76-0343] N77-26867
Thinning of a point process over time
[AD-A037491] N77-26894

TIME MEASUREMENT
Specular reflection timing predictions for the period preceding the 1977 vernal equinox
[AD-A036982] N77-26188

TIME SERIES ANALYSIS
Everyman's guide to TIMES
[AD-A035733] N77-26850
A Monte-Carlo study of robust estimators of location
[AD-A035739] N77-26899
Covariance analysis of some nonstationary time series
[AD-A037482] N77-26901

TIME SHARING
RATS operating system
[UCRL-77378] N77-26819
Feasibility study of networks
[COO-2487-4] N77-26864
Computer interfacing at LASL
[LA-UR-76-2502] N77-26866

TITANIUM
Casting titanium and zirconium in zircon sand molds
[PB-264253/6] N77-26292

TITANIUM ALLOYS
Nondestructive evaluation of metal fatigue
[AD-A037672] N77-26299

TOKAMAK FUSION REACTORS
Investigation of plasma confinement in a device with a three-dimensional axis
[BLL-CTO-1286-[9091.9F]] N77-26963
Spectroscopic investigations of adiabatic compression in a Tokamak
[BLL-CTO-1282-[9091.9F]] N77-26971
The kinetics of neutrals produced during the injection of an atom beam into the plasma
[BLL-CTO-1284-[9091.9F]] N77-26972
The initial stage of discharge development in Tokamaks
[BLL-CTO-1283-[9091.9F]] N77-26973
Accelerated electron beam instability in Tokamaks
[BLL-CTO-1262-[9091.9F]] N77-26975
Lower hybrid parametric instabilities nonuniform pump waves and Tokamak applications
[PPPL-1308] N77-26976
Status of Tokamak plasma physics
[PPPL-1296] N77-26978
Conceptual design study of a noncircular Tokamak demonstration fusion power reactor
[GA-A-13992] N77-26981
Impurity control in near-term Tokamak reactors
[CONF-760935-48] N77-26984

TOPOGRAPHY
Application of remote sensing techniques for the study and evaluation of natural resources in Peru
[E77-10171] N77-26573

TOPOLOGY
Optimizing path printed circuit board router --- for ILLIAC 4 computers
[UCRL-78564] N77-26408

TOROIDAL PLASMAS
Plasma heating in a toroidal system by a helical quadrupole RF field with omega omega sub Bi
[BLL-CTO-1292-[9091.9F]] N77-26965

TOROIDAL SHELLS
Laminated beams: Deflection and stress as a function of epoxy shear modulus
[PPPL-1287] N77-26313

TORQUE CONVERTERS
Design and development of a segmented magnet homopolar torque converter
[AD-A037259] N77-26149

TOWERS
Vibration characteristics of a large wind turbine tower on non-rigid foundations
[NASA-TM-X-73670] N77-26613

TOXIC HAZARDS
Influence of altered gaseous environments on lung metabolism
[AD-A037977] N77-26801

TOXICITY
Aerosol research and development related to health hazards analysis
[LA-6539-PR] N77-26703

TOXICOLOGY
Literature survey on toxicologic implications of manipulating some solid rocket propellants
[MBL-1976-12] N77-26326

TRACE CONTAMINANTS
XRF analysis of some regenerated catalysts
[MRL-TN-388] N77-26247
Multidisciplinary lidar system in Spacelab for application to atmospheric physics and remote sensing --- aerosols and trace gases
[BMFT-FB-W-76-23] N77-26597

TRACE ELEMENTS
Measurement techniques for inorganic trace materials in control system streams
[PB-264345/0] N77-26714

TRACKING FILTERS
Evaluation of an adaptive filter as a digital tracking filter
[SAND-76-5668] N77-26396

TRACKING RADAR
Low-altitude tracking development plan
[AD-A037593] N77-26218

TRAFFIC CONTROL
A computerized traffic control algorithm to determine optimal traffic signal settings
[NASA-TM-X-73607] N77-27035
Urban traffic control system traffic adaptive network signal timing program. Volume 1: Overview description; narrative description and flow charts of TANSTP routines
[PB-264054/8] N77-27040
Urban traffic control system traffic adaptive network signal timing program. Volume 2: Data base interface and support subroutines: Modified first generation routines
[PB-264055/5] N77-27041

Urban traffic control system traffic adaptive network signal timing program. Volume 3: UTCS/TANSTP data base and data base update procedures; offline support programs; operating porcedures
[PB-264056/3] N77-27042
TRAILING EDGES
Analysis of the separated boundary layer flow on the surface and in the wake of blunt trailing edge airfoils
[NASA-CR-145202] N77-26075
TRAINING DEVICES
Maximizing flight fidelity integration of Naval Air Test Center capabilities into the procurement of major aviation training devices
[AD-A037687] N77-26173
TRAJECTORY ANALYSIS
Program for trajectory calculation of pendulating projectiles
[ISL-R-104/76] N77-26917
TRAJECTORY CONTROL
Trajectory determination and telemetry receiving system evaluation
[AD-A037959] N77-26216
TRANSFER FUNCTIONS
The application of the Routh approximation method to turbofan engine models
[NASA-TM-X-73623] N77-26137
FTANAL: Computer-aided analysis of continuous and sampled linear control systems --- based on transfer functions N77-26911
TRANSFER ORBITS
Orbit transfer systems with emphasis on shuttle applications, 1986-1991
[NASA-TM-X-73394] N77-26198
TRANSFORMATIONS [MATHEMATICS]
Euler angles, quaternions, and transformation matrices for space shuttle analysis
[NASA-CR-151435] N77-26175
Transformation yielding reliability models based on independent random variables: A survey
[AD-A037969] N77-26527
TRANSISTORS
Excess noise in selected field-effect transistors
[LBL-5567] N77-26394
TRANSITION PROBABILITIES
Theoretical research in physics of highly ionized atoms
[COO-2557-1] N77-26931
TRANSMISSION LINES
Research and development efforts relative to superconducting materials
[CONS/2551-1] N77-26998
Comparative cost study of the processes for producing niobium-tin [Nb3 Sn] superconducting tapes for their application to power transmission lines
[ERDA-76-160] N77-26999
TRANSONIC FLIGHT
An exact hodograph method for the design of supercritical airfoils
[MBB-UFE-1168[O]] N77-26124
TRANSONIC FLOW
Analysis of an unsteady numerical scheme for calculation of transonic flow --- cascade flow N77-26444
TRANSONIC WIND TUNNELS
An experimental investigation using a normal jet plume simulator to determine jet plume effects on a long slender rocket configuration at Mach numbers from 0.2 to 1.5
[AD-A037735] N77-26093
TRANSPORT AIRCRAFT
Parametric study of transport aircraft systems cost and weight
[NASA-CR-151970] N77-26106
TRANSPORT PROPERTIES
Equilibrium and transport estimates for hydrogen and helium via Lennard-Jones fluid
[SAND-76-8710] N77-26434
Marginal stability analysis: A simpler approach to anomalous transport in plasmas
[AD-A036916] N77-26989
TRANSPORTATION
Technology transfer: Transportation
[NASA-CR-153272] N77-27034
Transportation-related data bases extracted from the national index of energy and environmental data bases. Part 1: Digest of detailed data base descriptions
[UCID-17316-PT-1] N77-27036
Transportation-related data bases extracted from the national index of energy and environmental data bases. Part 2: Detailed data base descriptions
[UCID-17316-PT-2] N77-27037
TRANSPORTATION ENERGY
Transportation-related data bases extracted from the national index of energy and environmental data bases. Part 1: Digest of detailed data base descriptions
[UCID-17316-PT-1] N77-27036
Transportation-related data bases extracted from the national index of energy and environmental data bases. Part 2: Detailed data base descriptions
[UCID-17316-PT-2] N77-27037
TRIATOMIC MOLECULES
Classical dynamics of triatomic system: Energized harmonic molecules
[CALT-767P4-49] N77-26929
TRITIUM
Conversion of tritiated hydrogen to water in the atmosphere
[BNWL-2113] N77-26737
TROPICAL REGIONS
Application of remote sensing techniques for the study and evaluation of natural resources in Peru --- northern Amazon jungle, Ica City, and Nazca lines
[E77-10172] N77-26574
TUBE HEAT EXCHANGERS
Heat transfer and pressure loss caused by coolant vaporization in a horizontal stream tube
[BLL-RTS-9956] N77-26419
TUNGSTEN
Laser-produced X-UV spectra of T6a and W
[AD-A035391] N77-26494
TUNNELING [EXCAVATION]
Seismic detection of subterranean cavities
[AD-A035711] N77-26744
TURBIDITY
Some basic considerations of measurements involving collimated direct sunlight
[NASA-CP-2010] N77-26622
TURBINE BLADES
Application of sputter-deposited lamellar composite technology to the development of high temperature turbine blade materials and airfoil fabrication
[AD-A037349] N77-26151
Plugging of cooling holes in film-cooled turbine vanes
[NASA-TM-X-73661] N77-26269
TURBINES
Vibration characteristics of a large wind turbine tower on non-rigid foundations
[NASA-TM-X-73670] N77-26613
TURBOFAN ENGINES
Design of turbofan engine controls using output feedback regulator theory
[NASA-TM-X-73622] N77-26136
The application of the Routh approximation method to turbofan engine models
[NASA-TM-X-73623] N77-26137
The effect of reliability and maintainability on the F-14A TF30P412A engine
[AD-A037985] N77-26525
TURBOGENERATORS
Preliminary analysis and feasibility study on high speed turbulence generator
[UCID-17291] N77-26433
TURBULENCE EFFECTS
Analysis of the separated boundary layer flow on the surface and in the wake of blunt trailing edge airfoils
[NASA-CR-145202] N77-26075
TURBULENT FLOW
The coherent flame model for turbulent chemical reactions
[AD-A036768] N77-26261
Preliminary analysis and feasibility study on high speed turbulence generator
[UCID-17291] N77-26433
Study of non-isoenergetic turbulent jet mixing in a constant area duct
[AD-A033498] N77-26446
Turbulent wake in a stratified medium
[AD-A036876] N77-26448
Fine scale structure of turbulent velocity fields
[AD-A035738] N77-26450
Transition in a boundary layer and in a pipe flow
[AD-A037664] N77-26453
An experimental study of the atmospheric boundary layer modified by a change in surface roughness and surface temperature
[NASA-CR-141422] N77-26730
An examination of turbulent dissipation in the marine boundary layer
[AD-A035706] N77-26783
Dissipative, forced turbulence in two-dimensional magnetohydrodynamics
[NASA-CR-152862] N77-26980
TURBULENT WAKES
Unsteady hovering wake parameters identified from dynamic model tests, part 1
[NASA-CR-152022] N77-26077
The energy balance in a vortex trail --- of two dimensional bodies
[OUEL-1162/76] N77-26090
Turbulent wake in a stratified medium
[AD-A036876] N77-26448
TWISTED WINGS
Optimum design of composite wing structures with twist constraint for aeroelastic tailoring
[AD-A038029] N77-26099
TWO DIMENSIONAL BODIES
The energy balance in a vortex trail --- of two dimensional bodies
[OUEL-1162/76] N77-26090
TWO DIMENSIONAL FLOW
Unsteady two-dimensional wing flow at large control surface angles
[MBB-UFE-1183[O]] N77-26089
Wind tunnel wall effects --- adaptive flow distribution
[AD-A037532] N77-26103
Energy dependent finite element method for two-dimensional diffusion problems
[LA-UR-77-59] N77-26940
Dissipative, forced turbulence in two-dimensional magnetohydrodynamics
[NASA-CR-152862] N77-26980
TWO PHASE FLOW
Electroless-nickel plating of a large turbine rotor for the geothermal program
[UCID-17253] N77-26286
Modeling two-phase flow in a swirl combustor
[COO-4062-2] N77-26432
The calculation of two phase pressure drop by means of an annular flow model
[OUEL-1181/77] N77-26442

U

U.S.S.R.
The controlled thermonuclear fusion research programme in the USSR for 1976 - 1977
[BLL-CTO-1296-[9091.9F]] N77-26969
UH-1 HELICOPTER
Aeromedical evaluation of UH-1 internal advanced personnel rescue hoists, Western Gear Corporation hoist models 42277R1 and 42305R1, Breeze Corporation hoist ECP-720 modification
[AD-A037621] N77-26130
ULTRAHIGH FREQUENCIES
Results of UHF radiometric and direct ground measurements of soil moisture in 1975
[NASA-TT-F-17521] N77-26726
ULTRAVIOLET RADIATION
On three-dimensional reconstruction of optically thin solar emission sources
[NASA-TM-X-71341] N77-27056
ULTRAVIOLET SPECTRA
Laser-produced X-UV spectra of T6a and W
[AD-A035391] N77-26494
UNDERGROUND STRUCTURES
Seismic detection of subterranean cavities
[AD-A035711] N77-26744
UNDERWATER STRUCTURES
Interference seals and connectors for undersea electrical applications
[AD-A036841] N77-26522
UNITED KINGDOM
The marine gas turbine: The UK provides a case study in technological development
[AD-A037686] N77-26535
UNITED NATIONS
World Weather Watch. Consolidated report on the voluntary assistance programme including projects approved for circulation in 1976
[WMO-465] N77-26774
UNITED STATES OF AMERICA
Internalizing social costs in power plant siting: Some examples for coal and nuclear plants in the United States
[CONF-761103-16] N77-26816
UNIVERSITIES
Observations on European low-temperature physics research: An annotated directory of low-temperature physics in British universities and some comments on the low temperature physics programs in Europe
[AD-A036959] N77-26339
Experiment in information sharing: The LLL-Atlanta University Workshops
[UCID-17340] N77-27026
UNIVERSITY PROGRAM
Remote sensing program --- Cornell University program
[NASA-CR-153288] N77-26568
UNSTEADY FLOW
Unsteady two-dimensional wing flow at large control surface angles
[MBB-UFE-1183[O]] N77-26089
Unsteady flow and flame propagation in a prechamber of a stratified charge engine
[SAND-75-8743] N77-26250
Comparison between possible variants of a program using an unsteady numerical scheme for calculation of the flow in a one-dimensional nozzle N77-26443
Analysis of an unsteady numerical scheme for calculation of transonic flow --- cascade flow N77-26444
Ionization instability of a non-self-sustaining discharge due to step ionization --- of gas mixtures
[BLL-CTO-1267-[9091.9F]] N77-26974
URANIUM
Effect of temperature on the mechanical properties of uranium
[SAND-76-6038] N77-26276
URANIUM 235
Isotope separation using metallic vapor lasers
[NASA-CASE-NPO-13550-1] N77-26477
URBAN PLANNING
Weather, climate and human settlements
[WMO-448] N77-27038

Management assistance for Texas city governments. Volume 1: Appendices A-C
[PB-264866/5] N77-27045

URBAN RESEARCH

National assessment of the urban particulate problem. Volume 1: Summary of national assessment
[PB-263665/2] N77-26715

National assessment of the urban particulate problem. Volume 2: Particle characterization
[PB-263666/0] N77-26716

URBAN TRANSPORTATION

A computerized traffic control algorithm to determine optimal traffic signal settings
[NASA-TM-X-73607] N77-27035

Urban traffic control system traffic adaptive network signal timing program. Volume 1: Overview description; narrative description and flow charts of TANSTP routines
[PB-264054/8] N77-27040

Urban traffic control system traffic adaptive network signal timing program. Volume 2: Data base interface and support subroutines: Modified first generation routines
[PB-264055/5] N77-27041

Urban traffic control system traffic adaptive network signal timing program. Volume 3: UTCS/TANSTP data base and data base update procedures; offline support programs; operating porcedures
[PB-264056/3] N77-27042

Vehicle follower longitudinal control for automated guideway transit vehicles
[PB-264554/7] N77-27044

URINE

Determination of antimicrobial susceptibilities of infected urines without isolation
[NASA-CASE-GSC-12046-1] N77-26797

USER MANUALS (COMPUTER PROGRAMS)

Low-speed V/STOL stability and control prediction. Volume 1: Model description and validation
[AD-A037688] N77-26158

Low-speed V/STOL stability and control prediction. Volume 2: Computer program user manual
[AD-A037689] N77-26159

Manual for adjustment and handling of platforms for data collection via satellite (CDCP)
[NASA-TM-75020] N77-26182

Four-D propagation code for high-energy laser beams: A user's manual
[UCID-17217] N77-26485

GRAPHELP user's manual: Version 2 --- FORTRAN
[AD-A037564] N77-26826

Optimization guide for programs compiled under IBM FORTRAN H (OPT=2)
[NASA-TM-X-71307] N77-26827

WAND user's guide
[AD-A037436] N77-26830

WAND user's guide. Addendum
[AD-A037335] N77-26831

User's guide for the STAR-100
[UCID-30133] N77-26837

CNESRO, CNSIM-CNSTAT programs for the study of the maintenance and availability of a space system. Volume 2: User's guide --- simulation and statistics programs for synchronous satellite systems
[ESA-TM-174-VOL-2] N77-26842

Everyman's guide to TIMES
[AD-A035733] N77-26850

Crysnet manual
[BNL-21714] N77-26863

User's guide to the Octopus computer network [the SHOC manual]
[UCID-30048-REV-3] N77-26868

KOVEC user's manual --- coding elastic and plastic properties
[UCID-17306] N77-27018

The computation and graphical display of the NSF Water Quality Index from the STORET data base using the integrated plotting package. Program documentation and users guide
[PB-264670/1] N77-27043

USER REQUIREMENTS

Rand library evaluation survey
[AD-A037917] N77-27030

UTAH

Analysis and testing of JP-5 fuel derived from coal
[AD-A036073] N77-26333

Application of standard photogeologic techniques to LANDSAT imagery for mineral exploration in the basin and range province of Utah and Nevada
[E77-10170] N77-26572

University of Utah direct contact Geothermal Power Project report. A computer program for determining the thermodynamic properties of water
[UTEC-ME-76-171] N77-26642

UTERUS

A cervix-to-rectum measuring device in a radiation applicator for use in the treatment of cervical cancer
[NASA-CASE-GSC-12081-2] N77-26796

UTILITIES

Energy Conversion Alternatives Study (ECAS), phase 2. Volume 1: Executive summary
[NASA-CR-134949-VOL-1] N77-26631

Energy Conservation Alternatives Study (ECAS), phase 2: Volume 2: Advanced energy conversion systems, - conceptual designs. Part 1: Analytical approach
[NASA-CR-134949-VOL-2-PT-1] N77-26632

Energy Conversion Alternatives Study (ECAS), phase 2. Volume 2: Advanced energy conversion systems - conceptual designs. Part 2: Closed turbine cycles
[NASA-CR-134949-VOL-2-PT-2] N77-26633

Energy Conversion Alternatives Study (ECAS), phase 2. Volume 2: Advanced energy conversion systems - conceptual designs. Part 3: Open cycle gas turbines and open cycle MHD
[NASA-CR-134949-VOL-2-PT-3] N77-26634

Energy Conversion Alternatives Study (ECAS), phase 2. Volume 2: Advanced energy conversion systems: Conceptual designs. Part 4: Summary of results
[NASA-CR-134949-VOL-2-PT-4] N77-26635

Energy Conversion Alternatives Study (ECAS), phase 2. Volume 3: Research and development plans and implementation assessment
[NASA-CR-134949-VOL-3] N77-26636

Energy Conversion Alternatives Study (ECAS), phase 2. Integrated coal gasifier/molten carbonate fuel cell powerplant conceptual design and implementation assessment
[NASA-CR-134955] N77-26637

Hydrogen storage via metal hydrides for utility and automotive energy storage applications
[BNL-21723] N77-26666

UTILIZATION

Potential use of power plant reject heat in commercial aquaculture
[ORNL/TM-5663] N77-26662

V

V/STOL AIRCRAFT

Static, noise, and transition tests of a combined-surface-blowing V/STOL lift/propulsion system
[NASA-CR-151954] N77-26139

Low-speed V/STOL stability and control prediction. Volume 1: Model description and validation
[AD-A037688] N77-26158

Low-speed V/STOL stability and control prediction. Volume 2: Computer program user manual
[AD-A037689] N77-26159

VACUUM CHAMBERS

Pulsed plasma plume studies
[AD-A036904] N77-26236

VALENCE

The structure of a mixed-valence iron fluoride, Fe2F5.2H2O
[AD-A035714] N77-26266

VANADIUM COMPOUNDS

Evaluation of sulfosalts
[AD-A037946] N77-27015

VAPOR DEPOSITION

Optical materials characterization --- refractive indices of chemical vapor deposited ZnS
[AD-A037525] N77-26960

VAPOR PHASES

Absolute rate constant for the reaction of atomic chlorine with hydrogen peroxide vapor over the temperature range 265-400 K
[NASA-TM-X-71340] N77-26248

VAPOR PRESSURE

Vapor-pressure measurements by effusion methods
[PB-264295/7] N77-26290

VARIABILITY

A comparison of two independent measurements and analysis of jet aircraft flyover noise
[NASA-TN-D-8379] N77-26920

VARIABLE SWEEP WINGS

Low-speed wind tunnel tests of 1/9-scale model of a variable-sweep supersonic cruise aircraft --- conducted in the Langley full-scale wind tunnel
[NASA-TN-D-8380] N77-26070

Treatment of the nonlinear vibration of a variable sweep aircraft wing with its drive using a simplified wing model
[MBB-UFE-1191(O)] N77-26156

VARIATIONS

An extended set of cosmic ray variational coefficients for European cosmic ray stations
[AD-A036992] N77-27062

VECTOR ANALYSIS

Vectorized general sparsity algorithms with backing store
[AD-A037971] N77-26892

VEHICLE WHEELS

Engineering design handbook: Analysis and design of automotive brake systems
[AD-A035143] N77-26519

VELOCITY MEASUREMENT

VISAR measurements of velocities in explosive valves
[SAND-76-8048] N77-26460

VENTILATION FANS

An approach to low noise axial flow fan design, manufacture and testing
N77-26922

VENTS

Explosive tests for establishing hazard classification for M1 SP propellant in automated single-base finishing operations
[AD-A037383] N77-26336

VERTICAL LANDING

Helicopter optimal descent and landing after power loss
[NASA-TM-X-73244] N77-26067

VERY LOW FREQUENCIES

VLF/LF reflectivity of the polar ionosphere, 20 July - 20 September 1975
[AD-A036913] N77-26376

VIBRATION

The general solution to the classical problem of finite Euler Bernoulli beam
[NASA-TM-X-73253] N77-26533

The stability of a beam subjected to a moving mass
[AD-A037719] N77-26566

VIBRATION DAMPING

Identification of natural frequencies and modal damping ratios of aerospace structures from response data
[NASA-CR-151419] N77-26532

VIBRATION EFFECTS

Vibration characteristics of a large wind turbine tower on non-rigid foundations
[NASA-TM-X-73670] N77-26613

VIBRATION MEASUREMENT

An evaluation of reaction wheel emitted vibrations for space telescope
[NASA-CR-150303] N77-26181

Analysis of a cylindrical shell vibrating in a cylindrical fluid region
[ANL-76-48] N77-26544

VIBRATION MODE

Identification of natural frequencies and modal damping ratios of aerospace structures from response data
[NASA-CR-151419] N77-26532

VIDEO COMMUNICATION

Local, regional and large scale integrated networks; Volume 4. Local and regional communication networks - technologies and architectures
[AD-A035952] N77-26353

VIRGINIA

Applications of remote sensing to estuarine management
[NASA-CR-153287] N77-26585

VISUAL CONTROL

Delay of visual feedback in aircraft simulators
[AD-A037839] N77-26169

VISUAL PERCEPTION

Prediction of modulation detectability thresholds for line-scan displays
[AD-A035735] N77-26384

Automatic pattern recognition in a multi-sensor environment
[AD-A037968] N77-26880

VISUAL SIGNALS

Improvement of the picture definition of a television signal of limited frequency bandwidth by linear measures
[BLL-RTS-10578] N77-26342

VOLCANOLOGY

Evolution of silicic magma chambers and their relationship to basaltic volcanism
[LA-UR-76-1708] N77-26734

VOLTAGE CONVERTERS (DC TO DC)

Air-gapped structures as magnetic elements for use in power processing systems
[NASA-CR-153289] N77-26627

VOLTMETERS

Square wave voltammetry at the dropping mercury electrode, theoretical
[AD-A035970] N77-26389

VORTEX STREETS

The energy balance in a vortex trail --- of two dimensional bodies
[OUEL-1162/76] N77-26090

W

WAKES

The initial roll-up of a thick, two-dimensional wake behind a wing of finite span
[AD-A037033] N77-26104

WALL FLOW

Wind tunnel wall effects --- adaptive flow distribution
[AD-A037532] N77-26103

WALL PRESSURE

Wall pressure fluctuations in a bubbly flow
[OUEL-1157/76] N77-26440

WALLS
Air blast effects on concrete walls
[ANL-CT-76-50] N77-26540
Impurity control in near-term Tokamak reactors
[CONF-760935-48] N77-26984
WANKEL ENGINES
Performance, emissions, and physical characteristics of a rotating combustion aircraft engine
[NASA-CR-135119] N77-26134
WARPAGE
Casting warpage study
[BDX-613-1368] N77-26514
WASTE DISPOSAL
Water diffusion membranes 3 [pervaporation and heat rejection through composite membranes]
[NASA-CR-151967] N77-26423
Basic hydrogeologic and remote sensing data for selection of sanitary landfill sites
[NASA-CR-153280] N77-26587
WASTE UTILIZATION
Bioconversion of agricultural wastes for pollution control and energy conservation
[TID-27164] N77-26675
WASTE WATER
Potential use of power plant reject heat in commercial aquaculture
[ORNL/TM-5663] N77-26662
WATER
Intergranular stress corrosion cracking of sensitized chrome-nickel steels in boiling water
[ORNL-TR-4272] N77-26287
Water as dielectric in high-voltage impulse devices
[UCRL-TRANS-11185] N77-26395
Hydration-dehydration cycling of MgO-Mg[OH]2 for application to solar heat storage systems
[AI-ERDA-13178] N77-26654
Conversion of tritiated hydrogen to water in the atmosphere
[BNWL-2113] N77-26737
Measuring the radioactivity of drinking water with the liquid counters M2H in combination with contamination meters IM 4457
[MBL-1976-10] N77-26934
WATER EROSION
Erosion protection for the AH-1 G low radar cross-section main rotor blade. Volume 1: Sand and rain erosion evaluation
[AD-A035961] N77-26123
WATER FLOW
A test of the use of thermistor sensors for measuring small rates of water flow
[BLL-RTS-10421] N77-26455
WATER POLLUTION
Performance of coherent-on-receive synthetic aperture side looking airborne radar --- for oil slick detection
[AD-A035032] N77-26366
WATER QUALITY
Remote sensing of effects of land use practices on water quality
[NASA-CR-150306] N77-26581
Basic hydrogeologic and remote sensing data for selection of sanitary landfill sites
[NASA-CR-153280] N77-26587
Workshop report integrating Water quality and Water and Land Resources Planning
[PB-263476/4] N77-26601
Water resources data for California, 1975. Volume 1: Colorado River basin, southern great basin from Mexican border to Mono Lake Basin, and Pacific slope basins from Tijuana River to Santa Maria River
[PB-264474/8] N77-26602
Water resources data for California, 1975. Volume 3: Southern Central Valley Basins and the Great Basin from Walker River to Truckee River
[PB-264476/3] N77-26604
Water resources data for California, 1975. Volume 4: Northern Central Valley Basins and the Great Basin from Honey Lake Basin to Oregon State line
[PB-264477/1] N77-26605
The computation and graphical display of the NSF Water Quality Index from the STORET data base using the integrated plotting package. Program documentation and users guide
[PB-264670/1] N77-27043
WATER RESOURCES
Basic hydrogeologic and remote sensing data for selection of sanitary landfill sites
[NASA-CR-153280] N77-26587
Statistical information on activities in operational hydrology --- networks
[WMO-464] N77-26599
Workshop report integrating Water quality and Water and Land Resources Planning
[PB-263476/4] N77-26601
Water resources data for California, 1975. Volume 2: Pacific slope basins from Arroyo Grande to Oregon State line except Central Valley
[PB-264475/5] N77-26603
Water resources data for California, 1975. Volume 3: Southern Central Valley Basins and the Great Basin from Walker River to Truckee River
[PB-264476/3] N77-26604
Water resources data for California, 1975. Volume 4: Northern Central Valley Basins and the Great Basin from Honey Lake Basin to Oregon State line
[PB-264477/1] N77-26605
WATER TEMPERATURE
Analysis of thermal performance of Solaris water-trickle solar collector
[CONF-761107-17] N77-26668
Evaluation of Solaris water-trickle solar collector and demonstration of annual cycle collection and storage of solar heated water
[CONF-761143-1] N77-26669
Comparative performance of solar heating with air liquid systems
[COO-2868-1] N77-26676
WATER TREATMENT
Enzyme process design for water treatment
[PB-264504/2] N77-27039
WATER VAPOR
Water diffusion membranes 3 [pervaporation and heat rejection through composite membranes]
[NASA-CR-151967] N77-26423
Water vapor, nitric acid and ozone mixing ratio height profiles derived from spectral radiometric measurements
[AD-A037375] N77-26738
WATER WAVES
GSFC short pulse radar, JONSWAP-75
[NASA-TN-D-8502] N77-26457
WATERSHEDS
Demonstration to characterize watershed runoff potential by microwave techniques
[NASA-CR-151426] N77-26579
WAVE AMPLIFICATION
Distributed feedback acoustic surface wave oscillator
[NASA-CASE-NPO-13673-1] N77-26919
WAVE DISPERSION
Cavity detection by means of seismic shear and compressional wave refraction techniques
[TID-27225] N77-26733
WAVE GENERATION
Trade-off investigations and detailed design of power inverters
[AD-A036027] N77-26407
WAVE PROPAGATION
A sensitive infrared imaging up converter and spatial coherence of atmospheric propagation
[NASA-CR-149891] N77-27048
WAVEFORMS
Trade-off investigations and detailed design of power inverters
[AD-A036027] N77-26407
WAVEGUIDES
The principles of dimensioning lined circular waveguides
[BLL-PO-3394-[9022.81]] N77-26346
Development of gallium arsenide for infrared windows
[AD-A037336] N77-26957
WAVES
Wave motion in low-pressure-ratio rectangular and pyramidal shock tubes
[UTIAS-199] N77-26421
WEAPON SYSTEMS
Avionics evaluation program: Multiple aircraft, multiple sorties and cost accumulation
[AD-A037195] N77-26133
Computer controlled X-ray stress analysis for inspection of manufactured components
[AD-A037350] N77-26529
WEATHER
Meteorology and hydrology in aid of food production
N77-26755
Use of crop-weather models for assessing potential agricultural production
[REPT-891] N77-26756
Meteorological data, series B basic material. Volume 5, no. 3: European climatology 1975. Weather satellite data received in the Berlin area, part 3 --- ESSA 8 daily APT data
[QR-3-PT-3] N77-26772
Meteorological data; series B basic material. Volume 5, no. 4: European climatology 1975. Weather satellite data received in the Berlin area, part 4 --- ESSA 8 and NOAA 4 daily data
[QR-4-PT-4] N77-26773
Weather, climate and human settlements
[WMO-448] N77-27038
WEATHER FORECASTING
Forecast guides used for the centralized terminal forecast program
[AD-A035651] N77-26760
An approach to the short-range prediction of early morning radiation fog
[AD-A037961] N77-26765
Effects of weather on NATO/Warsaw pact air/ground operations
[AD-A037313] N77-26775
WEATHER STATIONS
Optical hazards of weather service instrumentation, January 1977
[AD-A037617] N77-26507
Forecast guides used for the centralized terminal forecast program
[AD-A035651] N77-26760
WEIGHT INDICATORS
Survey and experimental testing of nongravimetric mass measurement devices
[NASA-CR-151427] N77-26456
WEIGHT MEASUREMENT
The determination of the molecular weight distribution of polymers by permeation chromatography on porous glass. 1: Dextrans up to a molecular weight of 600000
[BLL-M-24884-[5828.4F]] N77-26246
WEIGHTLESSNESS
Survey and experimental testing of nongravimetric mass measurement devices
[NASA-CR-151427] N77-26456
WELD STRENGTH
Effect of lack of penetration on fatigue resistance of high-strength structural steel welds
[AD-A037047] N77-26302
Calculation of internal weld stresses and weld deformations by means of elasto-plastic finite elements
[BLL-RTS-10440] N77-26530
WELDED JOINTS
Examination of a failed transition weld joint and the associated base metals
[ORNL-5223] N77-26278
Fatigue resistance of welded joints in AlMg5 subjected to bending
N77-26552
Parametric analysis of the stresses in a cruciform axially loaded welded joint
[REPT-76-3] N77-26553
Data on the fatigue resistance of welded joints Al Mg5, volume 1
[REPT-76-4-VOL-1] N77-26554
Fatigue behavior of welded joints in Al Zn Mg1, Al Zn4 Mg1, and Al Mg Si [tables and diagrams]
[REPT-76-5-VOL-2] N77-26555
WELLS
Geophysical well logging for geohydrological purposes in unconsolidated formations
N77-26598
WET CELLS
Research and development in the glass fiber sodium-sulfur battery
[AD-A037215] N77-26694
Research and development of the glass fiber sodium-sulfur battery
[AD-A037216] N77-26695
Report for BA 494/U
[AD-A035722] N77-26700
WETLANDS
Application of LANDSAT-2 to the management of Delaware's marine and wetland resources
[E77-10173] N77-26575
Remote sensing of wetlands
[NASA-CR-153282] N77-26588
WETTABILITY
Non-reflective, wettable, fibrous fabric assemblies for firefighters' clothing
[AD-A038028] N77-26320
WHEAT
Estimated winter wheat yield from crop growth predicted by LANDSAT
[NASA-CR-151431] N77-26580
Measurement of growth, measurement and bidirectoral scattering parameters of wheat
[NASA-CR-151351] N77-26592
WHEEL BRAKES
Engineering design handbook: Analysis and design of automotive brake systems
[AD-A035143] N77-26519
WIND [METEOROLOGY]
Study of Alaskan wind power and its possible applications
[NSF/RANN/SE/AER74-00239/FR-26]
N77-26664
The 14805 Lance Missile numbers 3208/3207, round numbers 285 APT/286 APT, 29 July 1976
[AD-A037661] N77-26761
The 15002 Little John missile number 3139, round number 723 RG [11] January 1977
[AD-A037660] N77-26762
The 12817C Lance missile number 2162 ECT, 15 October 1976
[AD-A037941] N77-26763
The 12817A Lance Missile number 2241, round 292 number ECL, 20 October 1976
[AD-A037935] N77-26764
The 12815C Lance missile number 2473, round number 289 RST [7 October 1976]
[AD-A037940] N77-26777
The 12811A Lance missile number 2200, round number 293 RCL [13 January 1977]
[AD-A037939] N77-26778
The 15002A Little John missile number 1936, round number 722 RG [7 December 1976]
[AD-A037938] N77-26779
The 03702A Honest John missile number 1547, round number 655 AML [3 December 1976]
[AD-A037937] N77-26780

The 03702A Honest John missile number 1548, round number 654 AML [15 November 1976]
[AD-A037936] N77-26781
The 12811A Lance missile number 2611, round number 287 ACT [30 September 1976]
[AD-A037934] N77-26782
WIND DIRECTION
Control of a gliding parachute system in a non-uniform wind
[AD-A036076] N77-26102
WIND TUNNEL MODELS
An experimental investigation of incompressible flow over delta and double-delta wings
[AD-A035380] N77-26101
WIND TUNNEL NOZZLES
A computer program for the design of plane and axisymmetric supersonic wind tunnel nozzles
[ESA-TT-367] N77-26170
WIND TUNNEL STABILITY TESTS
Low speed wind tunnel tests of 1/10-scale model of a blended-arrow supersonic cruise aircraft
[NASA-TN-D-8410] N77-26069
WIND TUNNEL TESTS
Application of system identification to analytic rotor modeling from simulated and wind tunnel dynamic test data, part 2
[NASA-CR-152023] N77-26078
Wind tunnel tests of supersonic lifting bodies at Mach number 1.5 to 4.0
[AD-A037380] N77-26097
An experimental investigation of incompressible flow over delta and double-delta wings
[AD-A035380] N77-26101
WIND TUNNEL WALLS
Wind tunnel wall effects — adaptive flow distribution
[AD-A037532] N77-26103
WINDMILLS [WINDPOWERED MACHINES]
An analysis of the feasibility of windmills for power generation in New York State
[RPI-TA-17] N77-26638
WINDPOWER UTILIZATION
Vibration characteristics of a large wind turbine tower on non-rigid foundations
[NASA-TM-X-73670] N77-26613
Evaluation of the potential environmental effects of wind energy system development
[ERDA/NSF-07378-75/1] N77-26663
Study of Alaskan wind power and its possible applications
[NSF/RANN/SE/AER74-00239/FR-26] N77-26664
WINDPOWERED GENERATORS
An analysis of the feasibility of windmills for power generation in New York State
[RPI-TA-17] N77-26638
WINDSHIELDS
Effects of laboratory simulated precipitation static electricity and swept stroke lightning on aircraft windshield subsystems
[AD-A037196] N77-26127
WING PANELS
Structural analysis of a wing part using the ASKA program system — F-28 aircraft
[NLR-TR-73030-U] N77-26549
WING PLANFORMS
Structural analysis of a wing part using the ASKA program system — F-28 aircraft
[NLR-TR-73030-U] N77-26549
WING TIP VORTICES
The initial roll-up of a thick, two-dimensional wake behind a wing of finite span
[AD-A037033] N77-26104
WINGLETS
Effect of winglets on a first-generation jet transport wing. 3: Pressure and spanwise load distributions for a semispan model at Mach 0.30
[NASA-TN-D-8478] N77-26083
WINGS
Unsteady two-dimensional wing flow at large control surface angles
[MBB-UFE-1183[O]] N77-26089
WIRE
Approximations for terms related to the kernel in thin-wire integral equations
[AD-A036729] N77-26416

X

X RAY ANALYSIS
XRF analysis of some regenerated catalysts
[MRL-TN-388] N77-26247
Radiographic analysis of sedimentary structures and depositional histories in Apollo 15 cores
[NASA-CR-153265] N77-27052
X RAY ASTRONOMY
OSO-8 X-ray observations of AM Herculis
[NASA-TM-X-71313] N77-27050
X RAY DIFFRACTION
The application of a curved graphite crystal monochromator to X-ray diffractometry
[AD-A037952] N77-26474
Computer controlled X-ray stress analysis for inspection of manufactured components
[AD-A037350] N77-26529
X RAY FLUORESCENCE
XRF analysis of some regenerated catalysts
[MRL-TN-388] N77-26247
Use of X-ray scattering in absorption corrections for X-ray fluorescence analysis of loaded filters
[BNWL-SA-5755] N77-26249
X RAY IRRADIATION
In vitro evaluation of some latent radioprotective compounds — cysteamine derivatives
[MBL-1976-11] N77-26792
X RAY SPECTRA
Laser-produced X-UV spectra of T6a and W
[AD-A035391] N77-26494
OSO-8 X-ray observations of AM Herculis
[NASA-TM-X-71313] N77-27050
X-ray and gamma-ray line production by nonthermal ions
[NASA-TM-X-71335] N77-27061
XENON FLUORIDE LASERS
Electrically initiated HCl chemical laser and threshold excitation of XeF and KrF lasers
[AD-A037732] N77-26481

Y

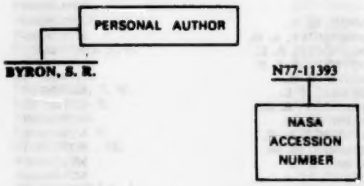
YAG LASERS
Cavity dump-PTM Nd:laser
[AD-A037193] N77-26504
Optical coatings 2-6 microns
[AD-A037257] N77-26961
YIELD STRENGTH
Experimental studies of yield phenomena in biaxially loaded metals
[LA-UR-76-1413] N77-26279

Z

ZETA THERMONUCLEAR REACTOR
Dynamics of a non-cylindrical Z-pinch and the particle acceleration mechanism
[BLL-CTO-1289-[9091.9F]] N77-26966
ZINC SELENIDES
Ion implantation in compound semiconductors
[AD-A037958] N77-27010
ZINC SULFIDES
Optical materials characterization — refractive indices of chemical vapor deposited ZnS
[AD-A037525] N77-26960
ZIRCALOYS [TRADEMARK]
Evaluating strength and ductility of irradiated Zircaloy. Task 5
[BMI-NUREG-1961] N77-26283
ZIRCONIUM
Casting titanium and zirconium in zircon sand molds
[PB-264253/6] N77-26292
ZIRCONIUM OXIDES
Zirconia-foil compatibility test. Phase 1
[TE-4219-28-77] N77-26645

PERSONAL AUTHOR INDEX

Typical Personal Author Index Listing



Listings in this Index are arranged alphabetically by personal author. The NASA accession number denotes the number by which the citation is identified.

A

ABARBANEL, S. S. N77-26105
ABENS, S. G. N77-26640
N77-26641
ABRAMOV, V. A. N77-26973
ABRAMS, R. L. N77-26495
ABSON, D. J. N77-26301
ACHTERMANN, E. N77-26597
ACKERSON, K. L. N77-26739
ADAM, E. N77-26998
ADAMS, A. N77-26290
ADAMS, R. W. N77-26416
ADAMSKI, J. N77-27002
AGGARWAL, J. K. N77-26441
AGRAWAL, A. K. N77-26277
AITKEN, K. L. N77-26226
AKERS, L. A. N77-26130
AKULINA, D. K. N77-26979
ALEXOVICH, R. E. N77-26183
ALI, M. L. N77-26176
ALIKHANOV, S. G. N77-26968
ALLEMOND, P. N77-26130
ALLEN, W. A. N77-26128
ALZANO, F. J. N77-26661
AMBA-RAO, C. L. N77-26533
AMOLS, H. I. N77-26799
ANAGNOSTOU, E. N77-26615
ANDERSON, E. C. N77-26798
ANDERSON, F. E. N77-26303
ANDERSON, G. L. N77-26566
N77-26918
ANDERSON, T. J. N77-26732
ANDRYUKHINA, E. D. N77-26979
ANGERMUELLER, K. N77-26212
ANTHES, J. P. N77-26482
ANYOS, T. N77-27034
APPEL, B. R. N77-26719
ARCAN, M. N77-26244
ARCELLA, F. G. N77-26149
ARMANTROUT, G. A. N77-26461
ARONSON, E. A. N77-26648
ASAWA, C. K. N77-26495
ASHOK, S. N77-26412
ASHURST, W. T. N77-26434
ATEN, J. B. T. N77-26934
ATZORI, B. N77-26551
N77-26552
N77-26553
N77-26554
N77-26555
AZZOPARDI, B. J. N77-26442

B

BAGGEROER, A. B. N77-26379
BAIER, W. N77-26756
BAILEY, A. G. N77-26231
BAILEY, S. M. N77-26130
BAIN, E. N77-26799
BAKER, B. S. N77-26640
N77-26641
BAKER, W. E. N77-26520
BAKHTIN, V. P. N77-26968
BAKHUIZEN, A. J. C. N77-26400
BALAKRISHNAN, A. V. N77-26887
BALCH, J. W. N77-26398
BALDWIN, G. D. N77-26504
BALTGALVIS, J. N77-26526
BANERJEE, D. N77-26078
BANKS, N. E. N77-26429
BARAM, Y. N77-26913
BARAN, H. A. N77-26132
BARDSLEY, J. N. N77-26931
BARKER, W. R. N77-26168
BARNES, C. E. N77-26995
BARNES, R. T. N77-26393
BARON, M. L. N77-26537
BARRETT, T. B. N77-27031
BARSCH, G. R. N77-27013
BARTLETT, D. N77-26575
BARTLETT, F. D., JR. N77-26523
BARTOLI, C. N77-26224
N77-26233
BARTON, J. R. N77-26299
N77-26820
BARZA, M. J. N77-26797
BASEDOW, A. M. N77-26246
BASHARINOV, A. Y. N77-26726
BASHKIN, S. N77-26263
BASS, R. R. N77-26636
BASTIEN, R. C. N77-26493
BATES, M. N77-26359
N77-26360
N77-26361
N77-26362
N77-26363
BATEY, J. N77-26661
BATIUK, G. N77-26084
N77-26093
BAUER, A. A. N77-26283
BAUER, R. C. N77-26447
BAXTER, T. N77-26951
BAZINET, M. L. N77-26245
BEALL, R. A. N77-26292
BEAMS, J. W. N77-26476
BEARD, J. T. N77-26668
N77-26669
BEARMAN, T. C. N77-27027
BEATY, E. C. N77-26987
BEAURAIN, L. N77-26152
BECK, R. N77-26597
BEECHER, D. T. N77-26628
N77-26629
N77-26630
BEERS, J. N. P. N77-26596
BEGUN, M. N77-26236
BEISHCHER, P. N77-26998
BEIZER, B. N77-26370
N77-26371
N77-26372
N77-26373
BELINA, F. W. N77-26108
BELL, H. H. N77-26813
BELLASSAI, M. C. N77-27028
N77-27033
BELTRAMO, M. N. N77-26106
BENHAM, R. A. N77-26189
BENSON, N. N77-26606
BENSON, P. E. N77-26558
BENSON, R. N77-26491
N77-26492
BEREZHETSKII, M. S. N77-26979
BEREZIN, A. B. N77-26964
BERG, E. N77-26751
BERGER, R. L. N77-26976
BERKE, L. N77-26099
BERKEY, E. N77-26149
BERKOPEC, F. D. N77-26385
BERKOWITZ, M. N77-26134
BERLAD, A. L. N77-26661
BERLINER, R. R. N77-27010
BERNSTEIN, R. B. N77-26927
BERZINS, G. J. N77-26464
BETHEL, J. S. N77-26699
BETZ, A. L. N77-27049
BEUFRERE, A. N77-26666
BHAGAT, P. K. N77-26802
BIALEK, J. N77-26313
BIELENBERG, C. N77-27029
BIENIEK, M. P. N77-26536
N77-26537
BIFFLE, J. H. N77-26815
BINDER, O. H. N77-27062
BIRKBY, H. J. N77-26167
BIRSS, E. W. N77-26818
N77-27036
N77-27037
BJORKMAN, W. S. N77-26111
BLAAS, C. N77-26548
BLACK, G. N77-26488
BLACK, H. D. N77-26196
BLACK, P. C. N77-26265
BLAIK, M. N77-26746
BLANCHARD, B. J. N77-26579
BLASENAK, J. H. N77-26446
BLASER, P. N77-26436
N77-26437
BLEICK, W. E. N77-26896
BLOKH, M. A. N77-26979
BLY, R. N77-26459
BODINE, E. T. N77-27010
BOEHM, R. F. N77-26642
BOENIG, H. J. N77-26649
BOES, D. J. N77-26149
BOES, E. C. N77-26653
BOESCHOTEN, F. N77-26986
BOHLEN, H. N77-26358
BOLDT, E. N77-27050
BONNER, R. S. N77-26503
BORIS, J. P. N77-26452
N77-26505
N77-26989
BORREGO, J. M. N77-26412
BOSCO, C. D. N77-26405
BOSTIAN, C. W. N77-26347
BOURKE, P. M. A. N77-26755
BOWERS, D. L. N77-26454
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BOYD, R. H. N77-26317
BOYD, R. W. N77-27047
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BOYLAN, J. F. N77-26273
BOYLE, R. J. N77-26617
BRADLEY, G. S. N77-26113
BRADLEY, L. P. N77-26487
BRADSHAW, J. C., III N77-26561
BRADWAY, R. M. N77-26715
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BRANDHORST, H. W., JR. N77-26625
BRANDT, W. E., JR. N77-26808
BRAU, M. J. N77-26957
BRAUN, C. N77-26666
BREEDING, K. J. N77-26880
BRIEHL, D. N77-26701
BRIGHTON, D. R. N77-26937
BRISTOL, M. A. N77-26132
BROADHURST, M. G. N77-27004
BROADWELL, J. E. N77-26261
BROCKMEYER, J. A. N77-26866
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BROWN, L. B. N77-27026
BROWN, R. A. N77-26133
BROWNELL, J. H. N77-26982
BRUCE, B. C. N77-26359

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	N77-26361	CLASONVANDERWIEL, H. J.
	N77-26362	COCH, N. K.
	N77-26363	COFFEY, P.
BRUCE, C.	N77-26489	COFFIN, L. F.
BRUSNIKIN, V. M.	N77-26968	COHEN, A. S.
BRYAN, J. P.	N77-26179	COHEN, M. L.
BUCCI, R. J.	N77-26300	COHEN, S. F.
BUCKINGHAM, A. C.	N77-26433	COHEN, S. R.
BUDKE, L.	N77-26792	COLE, R.
BUFANO, R.	N77-26554	COLE, S. E.
BUFORD, J. D.	N77-26120	
BULLIN, J. A.	N77-26724	COLEMAN, R. V.
BUNEMAN, O. P.	N77-26861	COLONNA-ROMANO, L. M.
BUNING, P. G.	N77-26892	COLTHRAP, G. B.
BUNSHAH, R. F.	N77-26316	COMER, J. J.
BURDEN, R. T.	N77-26130	COMFORT, W. J., III
BURGE, C. J.	N77-26609	CONN, R. W.
BURGER, L. L.	N77-26737	CONTI, P. R.
BURGESS, E. L.	N77-26647	COOK, C. C.
BURKE, M. F.	N77-26824	
BURKHALTER, J. E.	N77-26100	
BURKHALTER, P. G.	N77-26494	
BURNS, S. J.	N77-26541	
BURT, J. R., JR.	N77-26160	COOPER, R. B.
BURTON, J. D.	N77-26192	
	N77-26237	COPE, S. N.
BURTSCHER, J.	N77-26402	CORMAN, J. C.
BURTSEV, V. A.	N77-26964	
BUSCH, R.	N77-26151	
BUSH, L. R.	N77-26108	
BUSSARD, R. W.	N77-27061	CORREA, E. B.
BUTLER, D. M.	N77-26349	CORTES, R.
BUXTON, R. J.	N77-26087	
BUZZELL, C. E.	N77-26143	COWAN, R. D.
	N77-26144	COX, E. P.
BYE, R. L.	N77-26273	CRANE, R. K.
BYRON, S. R.	N77-26481	CREIGHTON, J. R.
		CREMERS, D. A.
		CREWS, S. T.
		CROWE, R. K.
		CROWSON, A.
CABASSO, I.	N77-26423	CULP, D. H.
CADOFF, M. A.	N77-26924	CURAMI, A.
CALAHAN, D. A.	N77-26892	CURRY, W. H.
CALVIN, M.	N77-26658	CURTIS, H. B.
CAMASSEL, J.	N77-26993	
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CAMEN, W.	N77-26089	
CAMP, D. C.	N77-26461	CUTTING, J.
CAMPBELL, D. V., JR.	N77-26470	CYTRON, S. J.
CAMPBELL, E. J.	N77-26864	
CAMPBELL, N. V.	N77-26172	
CAMPBELL, S. C.	N77-26803	
CANG, T. Y. P.	N77-26613	
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CAPSIMALIS, G. P.	N77-26529	DAHLKE, C. W.
CARLISLE, J. H.	N77-26874	
CARLSON, R. G.	N77-26135	DALMAN, G. C.
CARPENTER, J. A.	N77-26884	DALRYMPLE, R.
CARPENTER, S. G.	N77-26799	DANILKIN, I. S.
CARROLL, R. J.	N77-26899	DANNHAEUSER, F.
CARROLL, T. O.	N77-26595	DATTOMA, V.
CARROLL, W. F.	N77-26130	DAVENPORT, W.
CARTEN, A. S., JR.	N77-26098	
CARTER, B. D.	N77-26586	DAVIDHEISER, R.
CASSEL, T. A. V.	N77-26632	
CAUDILL, R. J.	N77-27044	DAVIDSON, J. A.
CAUDREY, A. J.	N77-26291	DAVIS, G.
CAVANAUGH, T.	N77-26744	DAVIS, G. T.
CECIL, A.	N77-26836	DAVIS, H. R.
CENTER, R. E.	N77-26481	DAVIS, R. H.
CESCHINI, L. J.	N77-26274	DAVIS, R., JR.
CHAFFEE, R. G.	N77-26310	DAVIS, S. J.
CHAI, A. T.	N77-26622	DEADMORE, D. L.
CHAMPAGNE, F. H.	N77-26450	DEAL, B.
CHANANI, G. R.	N77-26295	DEANE, G. L.
CHAPELLE, E. W.	N77-26797	DEAVER, B. S., JR.
CHAPPELL, C. F.	N77-26786	DEBOER, R.
CHARLSON, E. J.	N77-26652	DEBRUYN, J. C.
CHAUMONTET, C.	N77-26190	
CHAWLA, J. M.	N77-26419	
CHEBOTAEV, P. Z.	N77-26962	DECARLI, P. S.
CHEN, C. H.	N77-26878	DEGNER, J. D.
CHEN, C. J.	N77-26477	DELVALLE, P. F.
CHEN, L.	N77-26976	
CHENG, D. K.	N77-26377	DEMATTHAEIS, S.
CHERKESON, L. V.	N77-26788	DEMICHELE, C.
CHESLEY, D. M.	N77-26751	
CHIANG, T. C.	N77-26993	DEMING, J. W.
CHILD, R. D.	N77-26076	DEMIRKHANOV, R. A.
CHISM, S. B.	N77-26590	DEMMEL, E.
CHOU, P. C.	N77-26513	DENNIES, P. C.
CHOW, J. G. Y.	N77-26282	DEPIERRE, V.
CHOY, S.	N77-26826	DER, Z.
CHRISTE, K. O.	N77-26259	DEREGGI, A. S.
CHRISTENSEN, D. L.	N77-26611	DERRINGTON, D. B., JR.
CHRISTIE, J. H.	N77-26389	DESAI, P. D.
CHRISTOPHER, P. F.	N77-26195	DESCHUTTER, F.
CHRISTY, D. O.	N77-26872	DEVANE, J. F.
CHUKHLANTSEV, A. A.	N77-26726	DEYOUNG, R. J.
CHUNG, H.	N77-26544	DICELLO, J. F.
CLARK, J. W., JR.	N77-26158	DICKEY, J. W.
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CLARK, R.	N77-26805	
DIPIETRO, C.	N77-26245
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DIVEN, B. C.	N77-26280
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DOERLE, W. A.	N77-26143
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DOLAN, R.	N77-26750
DOLL, T.	N77-26810
DOMBROWSKI, M.	N77-26457
DONNELLEY, J. E.	N77-26818
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	N77-26870
DORE, M. A.	N77-26365
DORNHOFF, A. G.	N77-26866
DORWARD, R. C.	N77-26272
DOTSENKO, S. F.	N77-26788
DOWD, R. A.	N77-26132
DRAKE, R. L.	N77-26706
DRAXLER, R. R.	N77-26722
DREICER, H.	N77-26982
DREISEITLY, E.	N77-26646
DREMIN, M. M.	N77-26963
DUBIN, F. S.	N77-26660
DUFFY, M. A.	N77-26663
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DUFFY, R.	N77-26638
DUNCAN, C. V.	N77-26487
DUTHLER, C. J.	N77-27001
DUVALL, R. E.	N77-26172
DVORAK, V.	N77-26925
DWYER, H. A.	N77-26250
DYE, W. H.	N77-26197

E

EASTMAN, L. F.	N77-26383
EATON, L. R.	N77-26741
EBERLE, A.	N77-26124
EBERT, K. H.	N77-26246
ECKELS, J. D.	N77-26983
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EDERER, H.	N77-26246
EDWARDS, B.	N77-26727
EICHELBERGER, J. C.	N77-26734
EISENBERG, B. R.	N77-26348
ELACHI, C.	N77-26919
ELBAUM, M.	N77-26509
ELFIMOV, A. G.	N77-26965
ELLIS, R. F.	N77-26982
ELSKAMP, D. M. W.	N77-26326
EM, P. A.	N77-26268
ENGEL, H. E.	N77-26132
ENGLISCH, W.	N77-26597
EPSTEIN, M. M.	N77-27020
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ERICKSON, J. C., JR.	N77-26103
ERLICH, D. C.	N77-26459
ERTLSCHWEIGER, J. T., II	N77-26846
ERVIN, G.	N77-26654
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ESPINOSA, H. A.	N77-26569
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EVANS, R. S., II	N77-26656
EWANIZKY, T. F.	N77-26498
EWINS, J. H.	N77-26461
EYL, A. W., JR.	N77-26146

F

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FABRIS, G.	N77-26988
FAIRCHILD, C. I.	N77-26703
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FINLEY, R.	N77-26576
FINNEY, C. D.	N77-26656
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FISCHELL, D. R.	N77-26796
FISCHER-COLBRIE, E.	N77-26652
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FISHELSON, G.	N77-26708
FISHER, A.	N77-26506
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FLANNELLY, W. G. N77-26523
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FLEMING, W. T. N77-26451
FLEMINGS, M. C. N77-26273
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FORSBERG, T. W. N77-26523
FORSEN, G. E. N77-26956
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FOSSUM, J. F. N77-26647
FOSTER, M., JR. N77-26118
FOX, G. R. N77-26631
FOX, J. H. N77-26447
FRANCAVILLA, A. N77-26518
FRANCHI, P. R. N77-26355
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FRASER, D. E. N77-26366
FRAZIER, T. P. N77-26119
FREDERICKS, W. J. N77-27014
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FRIEDMAN, A. S. N77-26188
FRINT, H. K. N77-26129
FRITTS, M. J. N77-26452
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FU, W. N77-26383
FUNARO, J. N77-26537
FURCHNER, J. E. N77-26798
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G

GAHN, R. F. N77-26612
GALIMOV, E. M. N77-26240
GALKIEWICZ, R. C. N77-26715
GALLOWAY, R. T. N77-26173
GAMBLE, H. R. N77-26141
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GARDNER, E. M. N77-26821
GARDNER, H. R. N77-26151
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GARRARD, W. L. N77-27044
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GEE, T. E. N77-26130
GEERTSEMA, I. H. N77-26547
GEISS, H. N77-26711
GEMMELL, D. S. N77-26933
GEORGE, M. N77-26640
GERRITSEN, R. N77-26830
N77-26832
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GEUTJES, A. J. N77-26439
GIANOLA, S. V. N77-26811
GIEBLER, M. N77-26473
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GILL, F. R. N77-26163
GILLESPIE, J. B. N77-26950
GINER, J. N77-26673
GINGRICH, P. B. N77-26076
GITMAN, I. N77-26350
N77-26351
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GLAROS, S. S. N77-26983
GLASIER, J. M. N77-26132
GLUSHKOV, I. S. N77-26968
GOESSL, H. N77-26202
GOFF, M. R. N77-26805
GOLDBERG, J. N77-27024
GOLDMAN, A. N77-26738
GOLDSMITH, A. N77-26260
GOLDSMITH, T. C. N77-2704[illegible]
GOLDSTEIN, L P. N77-2684[illegible]
N77-26848

GOLUBEV, S. A.
GONCALVES, D.
GONZALEZ, R. C.
GOOLEY, R.
GORADIA, S. H.
GORDON, H.
GORDON, H. H.
GORDON, R. S.
GOTTLIEB, J. J.
GOTTLIEB, M. B.
GOULD, L.

GOYAL, A.
GRACE, O. D.
GRACIA, J. A.
GRAHAM, C. D.
GRAHAM, G.
GRANT, G. A.
GRANT, R. W.
GRAVES, D. H.
GRAY, C. R.
GRAY, R. J.
GREBENSHCHIKOV, S. Y.
GREENWAY, M. E.
GREGORY, D. L.
GREIG, J. R.
GRENANDER, U.
GRETHER, D. F.
GRUBER, R. P.
GRUEMMER, K.
GRUVER, R. M.
GSCHNEIDNER, K. A., JR.
GUERIN, M.

GUMAN, W. J.
GUNKEL, W. W.
GUPTA, N. K.
GUREEV, K. G.
GURNETT, D. A.
GURNEY, F. J.
GUST, W. H.
GUTMANN, R. J.

H

HAFNER, H. C.
HAGENLOCHER, K.
HAGGERTY, R. F.
HAGSTROM, K.

HALL, D. W.
HALL, F. G.
HALL, I. J.
HALL, L. B.
HALL, W.
HALL, W. E., JR.
HALLDORSSON, T.
HALLIKAINEN, M.
HAMMER, J. R.
HAMMESFAHR, J.

HAMMOND, E. C., JR.
HAMMOND, J. L.
HAN, K. S.
HANAFI, H. I.
HANDAL, O. B.
HANNON, B. M.
HANTMAN, R.
HARPER, H.
HARPER, M. P.
HARPER, R.
HARRIS, G.

HARRIS, J. M.
HARRIS, L. P.

HARRIS, S. D.
HARRISON, I., JR.
HARRISON, T. G.
HARSTAD, K. G.
HART, E. W.
HART, R. E.
HARTMAN, R. E.
HARWOOD, P.
HASENZAHL, W. V.
HASHIN, Z.
HASSE, K. R.
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HAUSER, G.

HAVILL, T. N.
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[illegible]D, R. E.
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HEBBLE, T. L.

N77-26876 **HECKER, S. S.** N77-26279
N77-26974 **HEDMAN, J. O.** N77-26345
N77-26190 **HEIDT, F. D.** N77-26219
N77-26879 N77-26220
N77-26734 **HENDERSON, D. M.** N77-26175
N77-26075 **HENDERSON, J. H.** N77-26084
N77-26293 N77-26093
N77-26585 **HENNIGAR, H. F.** N77-26585
N77-26996 **HENNING, H.** N77-26951
N77-26421 N77-26952
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N77-26359 **HERAKOVICH, E. T.** N77-26271
N77-26360 **HERBSLEB, G.** N77-26287
N77-26361 **HERHUDTVONROHDEN, H. J.** N77-26225
N77-26362 N77-26233
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N77-26298 **HESS, G. B.** N77-26476
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N77-26670 **HIGGS, G. K.** N77-26586
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N77-26990 **HINDMARSH, A. C.** N77-26839
N77-26581 **HIRATA, T.** N77-26257
N77-26732 **HO, C. Y.** N77-26267
N77-26278 **HOBBS, P. V.** N77-26766
N77-26979 **HOBSON, D. O.** N77-26545
N77-26090 **HODKINSON, P. H.** N77-26550
N77-26396 **HOERMANN, E.** N77-26204
N77-26309 **HOFFER, E. M.** N77-26719
N77-26871 **HOFFMAN, J. L.** N77-26292
N77-26657 **HOFFMAN, T. J.** N77-26429
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N77-26236 **HOLT, S. B., JR.** N77-26347
N77-26675 **HOLWERDA, E.** N77-26793
N77-26131 **HOLZER, S. M.** N77-26561
N77-26966 **HOOG, K.** N77-26328
N77-26739 **HOPPE, U.** N77-26219
N77-26301 N77-26220
N77-26462 **HORN, J. D.** N77-26776
N77-26412 **HOROWITZ, D.** N77-26960
HORTON, R. E. N77-26072
HOSIER, K. E. N77-26461
HOSIER, R. N. N77-26920
HOUK, J. N77-26463
HOUNAM, D. N77-26211
N77-26957 **HOUTGAST, T.** N77-26921
N77-26205 **HRUBY, R. J.** N77-26111
N77-26529 **HRYCKOWIAN, E.** N77-26405
N77-26370 **HSI-HSIEN, H.** N77-26757
N77-26371 **HSIAO, G. C.** N77-26889
N77-26372 **HUANG, H. C.** N77-26410
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N77-26424 N77-26492
N77-26589 **HUCKSTEP, F. L.** N77-26668
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N77-26459 **HUGHES, C. L.** N77-26590
N77-26266 **HUMMEL, R.** N77-26891
N77-26131 **HUMPHREYS, E. A.** N77-26534
N77-26597 **HUNGER, H.** N77-26246
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N77-26825 **HUNT, G. H.** N77-26162
N77-26213 N77-26167
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N77-26458 **HUPP, B.** N77-26576
N77-26380 **HURT, G. J., JR.** N77-26154
N77-26464 **HUSAK, V.** N77-26925
N77-27005 **HUSSAINI, M. Y.** N77-26533
N77-26182 **HYKES, G. R.** N77-26415
N77-26697
N77-26988

I

N77-26526 **IACHETTA, F. A.** N77-26668
N77-26289 N77-26669
N77-26473 **ILINSKII, S. E.** N77-26965
N77-26359 **INDRIO, P.** N77-26555
N77-26360 **INGRAHAM, J. C.** N77-26982
N77-26361 **INNES, R. G.** N77-26948
N77-26362 **ISAACS, T. J.** N77-27015
N77-26363 **ISTVAN, L. B.** N77-26578
N77-26879 **IUORNO, S. J.** N77-26382
N77-26634 **IVANOVSKIY, M. A.** N77-26979
N77-26636
N77-26431
N77-27026
N77-26130
N77-26477
N77-26275
N77-26624

J

N77-26844 **JACOB, K.** N77-26091
N77-26576 **JACOBS, H. R.** N77-26642
N77-26649 **JACOBS, O. L. R.** N77-26873
N77-26244 **JACOBS, P. F.** N77-26083
N77-26272 **JAECK, C. L.** N77-26140
N77-26461 **JANUSZKIEWICZ, S.** N77-26640
N77-26436 **JARVIS, I. B.** N77-27031
N77-26437 **JEFFERIS, J. G.** N77-26663
N77-26267 **JEHAN, H. I., JR.** N77-26898
N77-26750 **JENDRZEJCZYK, J. A.** N77-26544
N77-26123 **JENKINS, R. E.** N77-26196
N77-26857 **JENSEN, F. R.** N77-26200
N77-26435 **JENSEN, G. A.** N77-26665

JENSEN, R. N. N77-26617
JENSEN, T. A. N77-26822
JEWELL, W. J. N77-26675
JOHN, J. N77-26526
JOHNSON, C. H. N77-26336
JOHNSON, E. N77-26731
JOHNSON, G. G. N77-26632
N77-26635
JOHNSON, G. R. N77-26646
JOHNSON, J. P. N77-26470
JOHNSON, N. A. N77-26118
JOHNSON, W. N77-26067
N77-26068
JOHNSTON, S. W. N77-27039
JONES, D. L. N77-26296
JONES, R. A. N77-26081
JOSEPH, D. W. N77-26784
JOY, W. N. N77-26892
JOYCE, G. N77-26980

K

KADONTSEV, B. B. N77-26969
KAGANSKII, M. G. N77-26971
KAILATH, T. N77-26902
KAISER, F. N77-26420
KALB, M. N77-26752
KALININ, I. I. N77-26944
KALMYKOV, S. G. N77-26971
KALSHOVEN, J. E., JR. N77-26457
KANEMASU, E. T. N77-26580
KAPITSA, P. L. N77-26916
KARADENIZ, H. N77-26557
KARAKI, S. N77-26676
KARCH, G. W. N77-26783
KARP, D. N77-26114
KARTHAS, G. W. N77-26732
KASE, A. J. N77-26538
KASTNER, S. O. N77-27056
KAUFFMAN, S. R. N77-26347
KAUFMAN, E. H., JR. N77-26851
N77-26888
KAUFMAN, J. Y. N77-26469
KAUFMAN, L. N77-26461
KAW, P. K. N77-26976
KAWAI, H. N77-26318
KEESEE, R. L. N77-26384
KELLEY, W. N77-26286
KELLY, J. N77-26390
KELLY, M. F. N77-26408
KEMP, E. L. N77-26392
KEMPNER, J. N77-26562
KENDER, J. R. N77-26472
KENNEDY, J. M. N77-26271
KENNEY, G. N77-26473
KESSMANN, R. W. N77-27040
N77-27041
N77-27042
KEVAN, L. N77-26930
KHARLAMPOVICH, G. D. N77-26322
KHOT, N. S. N77-26099
KIM, S. N77-26266
KIMBROUGH, M. N77-26199
KIMOTO, B. W. N77-26106
KINDELAN, M. N77-26334
KING, C. S. N77-26564
KING, J. F. N77-26278
KING, J. M. N77-26637
KING, W. L. N77-26942
KINTNER, P. M. N77-26739
KIRBY, P. J. N77-26821
KIRCHNER, H. P. N77-26311
KIROV, A. G. N77-26965
KISSEL, G. N77-26155
KITCHENS, T. A. N77-26339
KITTINGER, D. C. N77-26171
KLATT, D. H. N77-26359
N77-26360
N77-26361
N77-26362
N77-26363
KLAUSUTIS, N. N77-27002
KLEIJN, D. J. N77-26986
KLEIN, R. E. N77-26697
KLEIN, S. A. N77-27057
KLEMAS, V. N77-26575
KLEMETTI, W. I. N77-26376
N77-26748
KLEMM, R. B. N77-26254
KLOVSTAD, J. W. N77-26359
N77-26360
N77-26361
N77-26362
N77-26363
KLUCHER, T. M. N77-26618
N77-26623
N77-26624
KLUG, W. N77-26735
KNOLL, R. H. N77-26617
KNOOK, D. L. N77-26789
KOCH, H. N77-26219
N77-26220
KOCH, R. K. N77-26292
KOHL, F. J. N77-26270
KOHLMAN, D. L.
KOHN, S.
KOKTA, L.
KOLESAR, C. E.
KOMEN, R.
KOMORIYA, H.
KORTOVICH, C. S.
KORZHAVIN, V. M.
KOSTERS, J. J.
KOT, C. A.
KOVALEV, A. S.
KRAATZ, P.
KRAFT, M. L.
KRAUSSE, J.
KRAUTH, G.
KREEB, H.
KRISHNA, C. R.
KRISTIANSEN, E.
KROKHIN, O. N.
KROLAK, M.
KRUGLOV, M. G.
KUBACKI, R. M.
KUBASOV, V. A.
KUESTER, J. L.
KUKUSHKIN, A. S.
KULKARNI, S.
KUNBERGER, W. A.
KUNZ, A. B.
KUPFERMAN, Z.
KUPPERMANN, A.
KURTMULLAEV, R. K.
KURZIUS, S. C.
KUSENBERGER, F. N.
KUTZ, R. L.
KYDES, A. S.

L

LAAPERI, A. N77-26600
LABBE, J. N77-26227
LAGERGREN, C. R. N77-26704
LAKIN, K. M. N77-26307
LAMPTON, M. N77-27050
LANDAU, C. N77-26819
LANDRY, M. J. N77-26468
LANDSBERG, A. N77-26290
LANDSBERG, H. E. N77-27038
LANE, R. A. N77-26409
LANGBERG, N. N77-26527
LANGNER, D. G. N77-26464
LANGSFORD, A. N77-26857
LARSEN, D. C. N77-26176
LATHWELL, D. J. N77-26675
LATTMAN, L. H. N77-26572
LAVASEK, J. W. N77-26482
LAWHON, W. T. N77-26324
LAWRENCE, F. V., JR. N77-26302
LAWRENCE, W. G. N77-26407
LAYDEN, O. P. N77-26404
LEAHY, W. R. N77-26809
LEASURE, W. A., JR. N77-26924
LEBEDEV, S. V. N77-26971
LECCHI, P. N77-26191
LEDBETTER, G. P. N77-26835
LEDGER, A. M. N77-26493
LEE, C. A. N77-26383
LEE, C. M. N77-26338
LEE, E. K. F. N77-26506
LEE, E. M., JR. N77-26524
LEE, J. H. N77-26248
N77-26479
LEE, K. L. N77-26461
LEE, T. Y. N77-26267
LEEMING, D. J. N77-26851
LEGRIVES, E. N77-26227
LEIBOFF, T. N77-26951
N77-26952
N77-27059
N77-27060
LEIGHTON, H. I. N77-26270
N77-26278
LEISZ, D. M. N77-27055
LEITNAKER, J. M. N77-26150
LEMAIRE, J. N77-26088
LEMKEY, F. D. N77-26438
LENGRAND, J. C. N77-26380
N77-26874
LEON, B. J. N77-26694
LEVIN, J. A. N77-26695
LEVINE, C. N77-26457
N77-26927
LEVINE, D. M. N77-26388
LEVINE, R. D. N77-26496
LEVY, L. N77-26432
LEWANTOWICZ, Z. H. N77-26365
LEWELLEN, W. S. N77-26531
LEWINSTEIN, M. N77-26275
LEYKO, J. N77-26568
LI, C. Y. N77-26726
LIANG, T. N77-26296
LIBERMAN, B. M. N77-26358
LIEBOWITZ, H. N77-26668
LIEPELT, K. N77-26669
LILLELEHT, L. U.
LIMBAUGH, C. C. N77-26122
LIN, C. N77-26994
LINAN, A. N77-26925
LIND, J. H. N77-26139
LINDBERG, J. D. N77-26986
LINDSEY, W. C. N77-26940
LINEBERGER, W. C. N77-26304
LINN, H. C. N77-26966
LIPINSKY, E. S. N77-26738
LITTLE, P. F. N77-26540
LITTLE, W. S. N77-26974
N77-26961
LITUNOVSKII, V. N. N77-26714
LIU, J. K. N77-26402
LIU, S. S. N77-26328
LIVINGSTON, P. M. N77-26219
LIZAK, R. N77-26220
LJUNG, L. N77-26254
LLACER, J. N77-26908
LO, J. T. H. N77-26970
LOBB, D. R. N77-26531
N77-26511
LOCKE, M. C. N77-26308
LODA, G. N77-26964
LOF, C. J. N77-26325
LOF, G. O. G. N77-26972
LOFTHOUSE, J. H. N77-26670
LOHKAMP, L. W. N77-27027
LONDON, R. L. N77-27008
LONG, A. N77-26320
LONG, R. K. N77-26929
LOOMIS, A. N77-26968
LOOMIS, K. N77-26497
LOOSE, D. R. N77-26299
LORCH, G. N77-26457
LORENZ, R. N77-26595
LORENZ, V. S.
LOU, D.
LOUIE, S. G. S.
LOUIS, E.
LOVELL, R. R.
LOW, R. D. H.
LOWE, D. S.
LOWELL, C. E.
LOWRY, L. M.
LOZOVSKII, S. N.
LUBBE, F. H.
LUCARIELLO, R.
LUCEY, D. J.
LUKES, D. L.
LUNIN, A. L.
LUTHER, R.
LYNN, D. A.
LYON, T. L.
LYSTAD, H. D.
LYUBLIN, B. V.

M

MACDONALD, B. C. N77-26646
MACDONALD, R. B. N77-26589
MACFARLAND, W. J. N77-26635
MACFARLANE, J. A. N77-26475
MACH, H. N77-26329
MACIOROWSKI, S. M. N77-26195
MACK, D. A. N77-26465
N77-26466
N77-27022
MACK, M. N77-26177
MACNEILL, R. N77-26810
MADDALONE, R. F. N77-26714
MADSEN, M. M. N77-26838
MAGEE, G. A. N77-26471
MAGEE, R. J. N77-26732
MAICKEL, R. P. N77-26795
MAINONE, D. N77-26490
MAJEWSKI, J. N77-26455
MAKHOUL, J. I. N77-26359
N77-26360
N77-26361
N77-26362
N77-26363
MALIN, P. N77-26576
MALLORY, W. R. N77-26470
MANHEIMER, W. N77-26989
MANN, W. C. N77-26874
MANUS, E. A. N77-26347
MANZIE, G. K. N77-26881
MARANCIK, W. N77-26998
MARBLE, F. E. N77-26261
MARCUS, R. A. N77-26258
MARGAND, F. N77-26915
MARKER, H. E. N77-26221
MARLOW, W. H. N77-26736
MARR, R. B. N77-26817
MARSH, D. P. N77-26106
MARSH, H. M. N77-26827
MARSHALL, R. E. N77-26347
MARSHALL, W. J. N77-26507
MARTELL, J. O. N77-26569
MARTIN, C. W. N77-26238
MARTIN, D. T. N77-26804
MARTIN, F. W. N77-26100
MARTIN, J. H., JR. N77-26675

MARTINEZ, J. E. N77-26560
MARTIRE, D. E. N77-27003
MARVIN, I. E. N77-26143
N77-26144
MASON, D. S. N77-26464
MASSE, D. N77-26414
MASUR, H. N77-26329
MATELAN, M. N. N77-26814
MATHEWS, F. H. N77-26189
MATHIEU, J. J. N77-26912
MATNEY, J. S. N77-26109
MATTIS, D. C. N77-27017
MATTOX, D. M. N77-26515
MATZKANNIN, G. A. N77-26299
MAURER, R. J. N77-26413
MAURITS, J. E. A. N77-27011
MAY, W. B., JR. N77-26668
N77-26669
MAZIQUE, J. N77-26796
MCBRIDE, D. D. N77-26178
MCCARTY, J. E. N77-26072
MCCARTY, R. S. N77-26141
MCCARTY, T. R. N77-26675
MCCLURE, T. A. N77-26324
MCCONAGHY, C. F. N77-26398
MCCOOL, J. M. N77-26357
MCCORMICK, G. P. N77-26890
MCCOY, D. F. N77-26802
MCCULLOCH, S. N77-26576
MCELREATH, K. W. N77-26812
MCGREGOR, W. K. N77-26502
MCGUIRK, J. P. N77-26646
MCHUGH, J. P. N77-27015
MCKENZIE, D. O. N77-26556
MCLAIN, R. J. N77-26376
N77-26748
MCLEMORE, H. C. N77-26069
N77-26070
MCMANUS, H. L., JR. N77-26143
N77-26144
MCMILLAN, J. N77-26440
MCNAIR, A. J. N77-26568
MCQUAID, E. P. N77-26256
MCRAE, K. I. N77-26474
MEADOR, W. E. N77-27054
MEHTA, J. M. N77-26075
MEIER, D. F. N77-26394
MEINERS, L. G. N77-27007
MEREDITH, R. E. N77-26501
MERENKOV, A. P. N77-26252
MERENKOV, P. T. N77-26252
MERKLE, C. L. N77-26449
MERKLE, R. G. N77-26900
MERRILL, W. C. N77-26136
N77-26137
MERRIMAN, S. C. N77-26807
MERRITT, C., JR. N77-26245
MESKAN, D. A. N77-26510
MICHAEL, J. V. N77-26248
MICHALOPOULOS, C. D. N77-26532
MIDDLETON, D. B. N77-26154
MIERKE, G. N77-26288
MIHALKANIN, P. A. N77-26528
MIKULAS, M. M., JR. N77-26242
MILGRAM, D. N77-26949
MILLER, C. D. N77-26606
MILLER, D. C. N77-26378
MILLER, D. L. N77-26997
MILLER, L. G. N77-26643
MILLER, M. L. N77-26847
N77-26848
N77-26876
MILLER, W. F. N77-26586
MILLS, M. T. N77-26720
MIMPEN, A. M. N77-26921
MINECK, R. E. N77-26082
MIRNOV, V. V. N77-26962
MITCHELL, P. A. N77-26591
MITTAL, Y. N77-26705
MITTELBACH, F. F. N77-27011
MITTERAUER, J. N77-26230
MOAK, C. D. N77-26932
MOHR, R. N77-26463
MOLE, C. J. N77-26149
MOLITZ, H. N77-26917
MOLL, H. N77-26836
MOLLOY, A. M. N77-26823
MONAHAN, H. H. N77-26765
MONTENEGRO, A. S. N77-26907
MONTGOMERY, D. N77-26980
MONTOYA, L. C. N77-26083
MOORE, J. A. N77-26874
MORALES, J. M. N77-26569
MORAN, D. D. N77-26095
MORANDA, P. B. N77-26849
MORENO, H. R. N77-26569
MORF, M. N77-26902
MORGAN, H. L. N77-26832
N77-26861
MORGANLANDER, M. N77-26803
MORITZ, H. N77-26749
MORRIS, G. R. N77-26675
MORRIS, G. V. N77-26366
MORRIS, J. R. N77-26485
MORSE, E. P. N77-26745
MOTKOWSKI, A. N77-26531
MOUNT, R. E. N77-26134
MROCH, A. B. N77-26415
MUELLER, B. N77-26343
MULCAHY, T. M. N77-26544
MULLAN, B. J. N77-26805
MUNDAY, J. C., JR. N77-26585
MUNSON, J. S. N77-26650
MURCRAY, D. G. N77-26738
MURPHY, D. N77-26576
MURRAY, J. R. N77-26484
MURRAY, L. O. N77-26338
MURRAY, R. W. N77-26264
MUZYCHENKO, A. D. N77-26968
MYERS, D. N77-26134

N

NABIEV, M. N. N77-26252
NAGEL, D. J. N77-26494
NARAYANKHEDHAR, K. G. N77-26337
NARDUCCI, L. M. N77-26954
NATHAN, R. A. N77-26324
NATHMAN, J. K. N77-26101
NAU, H. N77-26215
NEALE, R. S. N77-26335
NECHAYEV, Y. I. N77-26979
NEKRASOV, F. M. N77-26965
NELSON, L. Y. N77-26481
NEPHEW, E. A. N77-26659
NESTE, S. L. N77-26741
NESTOR, J. R. N77-26844
NEUBAUER, H. N77-26209
NEWMAN, L. N77-26713
NEWTON, R. N77-26503
NG, R. N77-26460
NICHOLS, J. C. N77-26834
NICHOLSON, W. L. N77-26991
NICKEL, H. N77-26219
N77-26220
NICKOLSON, V. J. N77-26789
NIELSEN, J. K. N77-26399
N77-26907
NIELSON, K. K. N77-26249
NIETUBICZ, C. R. N77-26097
NODA, T. N77-26951
N77-26952
NOH, W. F. N77-26430
NOLL, K. E. N77-26723
NOLLET, M. N77-26210
NORCROSS, D. W. N77-26931
N77-26987
NORRIS, C. B. N77-26995
NORTON, D. J. N77-26101
NORWITZ, G. N77-26293
NOSSA, G. A. N77-27043
NOTON, B. R. N77-27020
NOVIKOV, V. P. N77-26968
NOWACK, C. J. N77-26333
NUCKOLLS, J. H. N77-26938
NUNN, R. H. N77-26535
NUTTALL, R. L. N77-27019
NYCE, L. N77-27028
N77-27033
NYLAND, T. W. N77-26701

O

OAKEY, W. E. N77-26456
OBLASOVA, L. Z. N77-26322
OETTL, H. N77-26208
OHRI, A. K. N77-26627
OKAMARA, K. N77-26903
OLLILA, R. G. N77-27020
OLSON, W. P. N77-26740
OLSZEWSKI, M. N77-26662
OMIDVAR, K. N77-27061
ONITSENKO, V. V. N77-26965
ONKEN, R. N77-26165
ONUFRIYEV, A. T. N77-26448
OOSHI, V. B. N77-26149
ORTIZ, L. W. N77-26703
OSTERYOUNG, R. A. N77-26389
OTIS, J. L. N77-26324
OTTENS, H. H. N77-26549
OVSYANNIKOV, V. A. N77-26964
OWENS, E. C. N77-26330

P

PAILLOUS, A. N77-26388
PALMEDO, P. F. N77-26650
PALMER, M. A. N77-26482
PALMOUR, V. E. N77-27028
N77-27033
PAN, R. C. N77-27007
PANAGEAS, G. N. N77-26076
PAPPAS, T. N77-26094
PARADIS, J. N77-26522
PARAIL, V. V. N77-26975
PARASHAR, B. D. N77-26072
PARKER, F., JR. N77-26168
PARKES, R. N77-26232
PARLETT, L. P. N77-26069
N77-26070
PARR, C. A. N77-26929
PARRY, J. M. N77-26294
PARRY, W. T. N77-26606
PATTEN, J. W. N77-26151
PATTERSON, E. P. N77-26514
PAVEL, A. L. N77-26185
PAYNE, C. E. N77-27025
PAYNE, W. A. N77-26248
PEACOCK, J. N77-26506
PEARSON, A. E. N77-26102
N77-26187
PEARSON, F., II N77-26608
PEARSON, L. W. N77-26374
N77-26375
PEASE, M. C., III N77-27023
N77-27024
PECHACEK, R. E. N77-26309
PEEL, D. J. N77-26422
PEEL, J. L. N77-27011
PEELLE, E. N77-26816
PEKHOVICH, A. I. N77-26427
N77-26428
PELEVIN, V. N. N77-26944
N77-26953
PELZ, J. N77-26768
PEPPER, D. W. N77-26431
PEPPER, W. B. N77-26087
PERDU, M. N77-26219
N77-26220
PERINI, J. N77-26381
PERKINS, F. W. N77-26976
PERRIGO, L. D. N77-26665
PERRIN, J. S. N77-26283
PETRICK, M. N77-26988
PETRIE, S. L. N77-26935
PETTRY, D. E. N77-26586
PETTYJOHN, F. S. N77-26130
PEUTOV, Y. A. N77-26726
PFAUTH, M. N77-26810
PFEIFER, H. J. N77-26490
PFITZER, K. A. N77-26740
PHILIPSON, W. R. N77-26568
PHILLIPS, J. B. N77-26824
PHILPOT, W. N77-26575
PIAN, T. H. H. N77-26563
PICCIOLO, G. L. N77-26797
PICHUGIN, V. V. N77-26968
PIERSOL, A. G. N77-26186
PIERSON, E. N77-26988
PIETERS, C. N77-27051
PILCHER, J. O., II N77-26521
PILKEY, W. N77-26565
PINDROH, A. L. N77-26481
PINDZOLA, M. S. N77-26926
PINKSTON, W. T. N77-26479
PIPER, L. G. N77-26486
PISMENNYI, V. D. N77-26974
POGGIO, A. J. N77-26416
POGUTSE, O. P. N77-26973
N77-26975
POLASEK, J. C. N77-26724
POLGREEN, T. L. N77-26671
POMALAZA, J. N77-26573
N77-26574
POMEROY, B. D. N77-26633
N77-26635
N77-26636
POPYTAEV, A. N. N77-26964
PORTER, R. N. N77-26929
PORTNOY, H. N77-26104
POSEHN, M. R. N77-26543
N77-26813
POTOR, G., JR. N77-26812
POTTER, R. V. N77-26873
POULOSE, P. K. N77-26296
POWELL, C. A. N77-26702
POWELL, C. J. N77-26340
POWELL, H. T. N77-26484
PRASAD, C. R. N77-26254
PRATT, I. H. N77-26404
PRATT, W. K. N77-26947
PRESTOWITZ, C. V. N77-26306
PRICE, D. C. N77-26461
PRICE, D. R. N77-26675
PRINCE, E. N77-26991
PROKUDINA, T. M. N77-26953
PROSCHAN, F. N77-26527
PRYOR, L. L. N77-26196
PUIG, J. A. N77-26169
PUNWANI, D. V. N77-26672
PURLL, D. J. N77-26945
N77-26946
PUTVINSKII, S. V. N77-26972

Q

QUAM, W. N77-26463
QUIGLEY, E. F. N77-26539
QUINLIVAN, R. P. N77-26164
QUINZI, A. J. N77-26527

R

RADAJ, D. N77-26530
RAFF, R. A. V. N77-26321
RAGAN, C. E., III N77-26280
RAJU, M. R. N77-26799
RAKHIMOV, A. T. N77-26974
RAKHIMOVA, T. V. N77-26974
RAMATY, R. N77-27061
RANADE, M. B. N77-26298
RANAUDO, R. J. N77-26153
RANSON, W. F. N77-26243
RAO, B. M. N77-26101
RAO, G. V. N77-26274
RAO, M. M. N77-26901
RASMUSSEN, J. E. N77-26376
N77-26748
RATHER, J. D. G. N77-26478
RATLEY, L. O., III N77-26125
RAUBOLD, E. N77-26856
RAUSSER, G. C. N77-26708
REAM, W. K. N77-26468
REARDON, J. E. N77-26239
RECHTIEN, R. D. N77-26744
RECK, G. M. N77-26701
RECORD, F. A. N77-26716
REID, M. A. N77-26612
REILLY, J. J. N77-26666
REINS, D. A. N77-26811
REITER, E. R. N77-26646
RHOADES, R. A. N77-26801
RHODES, M. D. N77-26242
RIBEIRO, J. N77-26830
RICARD, G. L. N77-26169
RICE, G. P. N77-26130
RICHARDS, L. M. N77-26983
RICHMOND, C. R. N77-26798
RICHTER, R. P. N77-26172
RIEK, R. G. N77-26273
RIEMER, D. H. N77-26642
RINDE, J. N77-26836
RINDNER, R. N77-26336
RIVA, R. N77-26417
ROBERTS, R. P. N77-26397
ROBERTSON, A. S. N77-26632
ROBERTSON, J. E. N77-26610
ROBINSON, D. W. N77-26483
ROBINSON, G. N77-26951
ROCKAFELLAR, R. T. N77-26852
N77-26882
RODRIGUEZ-ITURBE, I. N77-26607
ROGERS, S. E. N77-26663
ROLLER, N. E. G. N77-26578
N77-26588
RONDALL, J. N77-26315
RONDON, E. E. C. N77-26369
ROOSILO, S. A. N77-27006
ROSENFELD, A. N77-26949
ROSSI, G. N77-26790
ROTH, M. N77-27055
ROTH, M. S. N77-26844
ROTHSCHILD, S. N77-26194
ROTHSCHILD, W. J. N77-26238
ROWBOTHAM, C. N77-26945
N77-26946
RUBIN, A. I. N77-26924
RUNDEL, R. D. N77-26349
RUSSELL, G. R. N77-26477
RUTH, B. E. N77-26584
N77-26587
RYUTOV, D. D. N77-26962

S

SACH, C. I. N77-26881
SAFFORD, A. T., III N77-26760
SAGALOWICZ, D. N77-27024
SALZANO, F. J. N77-26666
SAMPSON, J. N77-27002
SANBORN, J. B. N77-26595
SANDERS, B. R. N77-26250
SANDERS, C. W. N77-26367
N77-26368
SANDY, G. F. N77-20367
N77-26368
SANTINI, D. N77-26707
SARTORY, W. K. N77-26546
SATTERTHWAIT, M. L. N77-26072
SATTINGER, I. J. N77-26578
SAUNDERS, J. N77-26414
SAUTER, G. D. N77-26651
SAVITSKII, E. M. N77-26276
SAWYER, J. F. N77-26367
N77-26368
SCANTLEBURY, R. A. N77-26855
SCAVUZZO, R. J. N77-26613
SCHACK, C. J. N77-26259
SCHAEFER, D. J. N77-26380
SCHAEFFER, E. G. N77-26139
SCHELL, J. A. N77-26576
SCHICKER, P. N77-26859
SCHLITT, L. G. N77-26484
SCHLUTER, M. N77-26994
SCHMID, L. A. N77-26425
SCHMIDT, F. A. N77-26285
SCHNEIDER, A. N77-26367
N77-26368
SCHNEIDER, C. N77-26868
SCHOEN, A. H. N77-26139
SCHOEN, B. N77-26156
SCHOEN, M. N77-27030
SCHOLZ, C. H. N77-26728
SCHRADER, K. N77-26099
SCHROCK, C. G. N77-26797
SCHRODER, H. N77-26342
SCHULMAN, J. H. N77-26936
N77-27016
SCHULZ, G. N77-26157
SCHULZ, M. N77-26743
SCHUMAN, H. N77-26381
SCHWARTZ, H. J. N77-26614
SCOTT, B. C. N77-26766
SEARCH, C. T. N77-27029
SEARLE, W. B. N77-26247
SEGULAR, H. N77-26432
SEHITOGLU, H. N77-26697
SELDNER, K. N77-27035
SELLEN, J. M. N77-26491
N77-26492
SEM-JACKSON, C. W. N77-26800
SEMENOV, V. N. N77-26968
SENS, A. F. C. N77-26986
SERFOZO, R. F. N77-26894
SERLEMITSOS, P. N77-27050
SEWALL, W. G. N77-26070
SHABAIK, A. H. N77-26316
SHAFRANOV, V. D. N77-26967
SHAH, R. P. N77-26633
N77-26634
N77-26636
SHAKHOVETS, K. G. N77-26971
SHAMPINE, J. C. N77-26811
SHAPLAND, D. G. N77-26922
SHAW, M. N77-26833
SHEA, M. A. N77-27062
SHEN, M. N77-26318
SHEN, Y. R. N77-26993
N77-26994
SHEPPARD, W. J. N77-26324
SHERBAF, D. M. N77-26944
SHERWOOD, B. R. N77-27063
SHESHINSKI, R. N77-26709
SHIN, B. K. N77-27010
SHOGAN, R. P. N77-26274
SHREWSBURY, G. S. N77-26075
SHUTKO, A. M. N77-26726
SIDWELL, K. N77-26897
SIEGEL, A. I. N77-26809
SILBERT, M. G. N77-26280
SIMPSON, F. B. N77-26516
SIMPSON, T. R. N77-26109
SIMS, D. F. N77-26241
SINDELAR, F. L. N77-26813
SITES, J. R. N77-27007
SKOVHOLT, R. L. N77-26143
N77-26144
SKRELIN, A. L. N77-26944
SLAUGHTER, G. M. N77-26278
SLIFKIN, L. M. N77-27016
SLINEY, D. H. N77-26507
SLIVINSKY, V. W. N77-26983
SLON, R. N77-26073
SMALL, D. L. N77-26872
SMALLWOOD, D. O. N77-26396
SMART, D. F. N77-27062
SMIRNOV, A. V. N77-26964
SMIRNOV, V. G. N77-26964
SMITH, A. P. N77-26109
SMITH, B. M. N77-26119
SMITH, C. C. N77-26676
SMITH, D. L. N77-26984
SMITH, D. M. N77-26827
SMITH, D. R. N77-26786
SMITH, R. E. N77-26112
SMITH, R. J., II N77-26408
N77-26814
SNOW, L. S. N77-26174
SOLNTSEV, A. M. N77-26963
SOMERS, A. E. N77-26561
SOMERVELL, W. L., JR. N77-26646
SOO, P. N77-26282
SOPER, W. G. N77-26696
SPARKS, M. N77-27001
SPARLING, E. W. N77-26646
SPEAR, K. E. N77-27013
SPEARS, D. L. N77-27049
SPICER, C. W. N77-26784
SPITZER, C. F. N77-26822
SPRACKLEN, D. H. N77-26700
SRINIVASAN, S. N77-26666
SRIVASTAVA, R. D. N77-26332
STAATSMANN, H. N77-26219
N77-26220
STABRYLLA, R. G. N77-26135
STACEY, W. M., JR. N77-26984
STAKUTIS, V. J. N77-26775
STALEY, J. T. N77-26300
STALLMAN, R. M. N77-26411
STAPLES, B. R. N77-27019
STARKER, S. N77-26203
STARKOVICH, J. A. N77-26714
STARR, A. M. N77-26646
STEARNS, C. A. N77-26270
STEFANOUSKII, A. M. N77-26963
STEICHEN, J. M. N77-26281
STEINFELD, J. I. N77-26251
STEINMANN, A. E. N77-26559
STEKHUN, A. I. N77-26322
STEPHAN, K. N77-26418
STERN, R. W. N77-26720
STEWART, D. N77-26232
STEWART, D. M. N77-26744
STEWART, R. D. N77-26632
STICKLER, D. B. N77-26393
STICKSEL, P. R. N77-26663
STIEF, L. J. N77-26248
STIEGLER, J. O. N77-27000
STIEHL, C. N77-26810
STOFFELS, J. J. N77-26704
STOLARSKI, R. S. N77-26349
STOREY, J. W. V. N77-27049
STRACK, H. N77-26402
STRANG, W. N77-26945
N77-26946
STRASBURG, A. C. N77-26323
STRICKLAND, G. N77-26666
STRITTMATTER, R. N77-26436
N77-26437
STRONGIN, M. N77-26997
STUDER, P. A. N77-26386
STUTZMAN, W. L. N77-26347
SU, K. L. N77-26406
SUBRAMANIAN, R. V. N77-26321
SUNDQUIST, C. R. N77-26558
SURACE, C. J. N77-27030
SUSSMAN, G. J. N77-26411
SUTTON, E. C. N77-27049
SWANK, J. N77-27050
SWEETE, L. N77-26673
SWINSON, W. F. N77-26243
SWOPE, D. R. N77-26516

T

TABAKOFF, W. N77-26446
TARMAN, P. B. N77-26672
TASKA, J. N77-26484
TAYLOR, G. D. N77-26851
N77-26888
TAYLOR, P. C. N77-27012
TAYLOR, R. L. N77-26355
N77-26364
N77-26486
TENNEY, D. R. N77-26271
TEREKHOVA, V. F. N77-26276
TEREN, F. N77-26829
THAKKER, A. B. N77-26300
THOENES, J. N77-26497
THOMANEK, L. N77-26209
THOMAS, C. L. N77-26228
THOMAS, J. W. N77-26115
N77-26116
THOMAS, R. G. N77-26798
THOMAS, R. J. N77-27056
THOMPSON, D. N77-26868
THOMSON, K. D. N77-26080
THORNTON, C. G. N77-26405
TIELEMAN, H. W. N77-26730
TIMMERMAN, D. H. N77-26613
TIURI, M. N77-26600
TOBE, Y. N77-26302
TOBEY, R. A. N77-26799
TODD, T. E. N77-26172
TOLLE, D. A. N77-26663
TOLMIE, D. E. N77-26865
TOMAN, K. N77-26378
TONG, D. T. L. N77-26426
TOWNES, C. H. N77-27048
N77-27049
TRANSUE, M. L. N77-26292
TRAPP, D. L. N77-26106
TREES, D. P. N77-27030
TRUBNIKOV, B. A. N77-26966
TRUCKNER, W. G. N77-26300
TSANG, T. W. E. N77-26285
TUER, T. W. N77-26501
N77-26958
TURI, A. N77-26885
TURN, R. N77-27032
TURNER, A. P. L. N77-26284
TURNER, J. A. N77-26389
TURNER, R. D. N77-26649
TURPENING, R. M. N77-26733
TURTLE, J. P. N77-26376
N77-26748
TURTON, J. S. N77-26422
TURULA, P. N77-26540
N77-26544
TWOMEY, R. C. N77-26127
TYLKINA, M. A. N77-26276

U

UNGER, H. G. N77-26346
USHAKOV, V. Y. N77-26395
UTSCHIG, J. M. N77-26822

V

VADALA, E. T. N77-26096
VAGER, Z. N77-26933
VALDES, J. B. N77-26607
VANDERZIEL, A. N77-27005
VANDYKE, D. B. N77-26502
VANHEMMEN, J. J. N77-26934
VANHOEK, L. P. N77-26934
VANHOOK, H. J. N77-26414
VANIERSEL, A. W. M. N77-26986
VANSCHAIK, F. J. N77-26401
VANSLYKE, R. N77-26350
N77-26351
N77-26352
N77-26354
VARMA, A. K. N77-26432
VARNEY, R. N. N77-26262
VEKSHTEIN, G. E. N77-26962
VELLEND, H. N77-26797
VENKAYYA, V. B. N77-26099
VETLOV, I. P. N77-26758
VICKERS, R. S. N77-26577
VIDAL, R. J. N77-26103
VIKHREV, V. V. N77-26966
N77-26973
VILLEVIEILLE, M. A. N77-26759
VISSER, R. P. L. S. N77-26791
VLCEK, J. N77-26925
VOELZ, E. N77-26711
VOGL, H. N77-26213
VOGT, K. J. N77-26711
VOITCHOVSKY, J. P. N77-26993
N77-26994
VOLKER, M. N77-26725
VOLOSHIN, A. N77-26244
VORONOV, G. S. N77-26979
VOS, O. N77-26792
VOSS, P. N77-26402

W

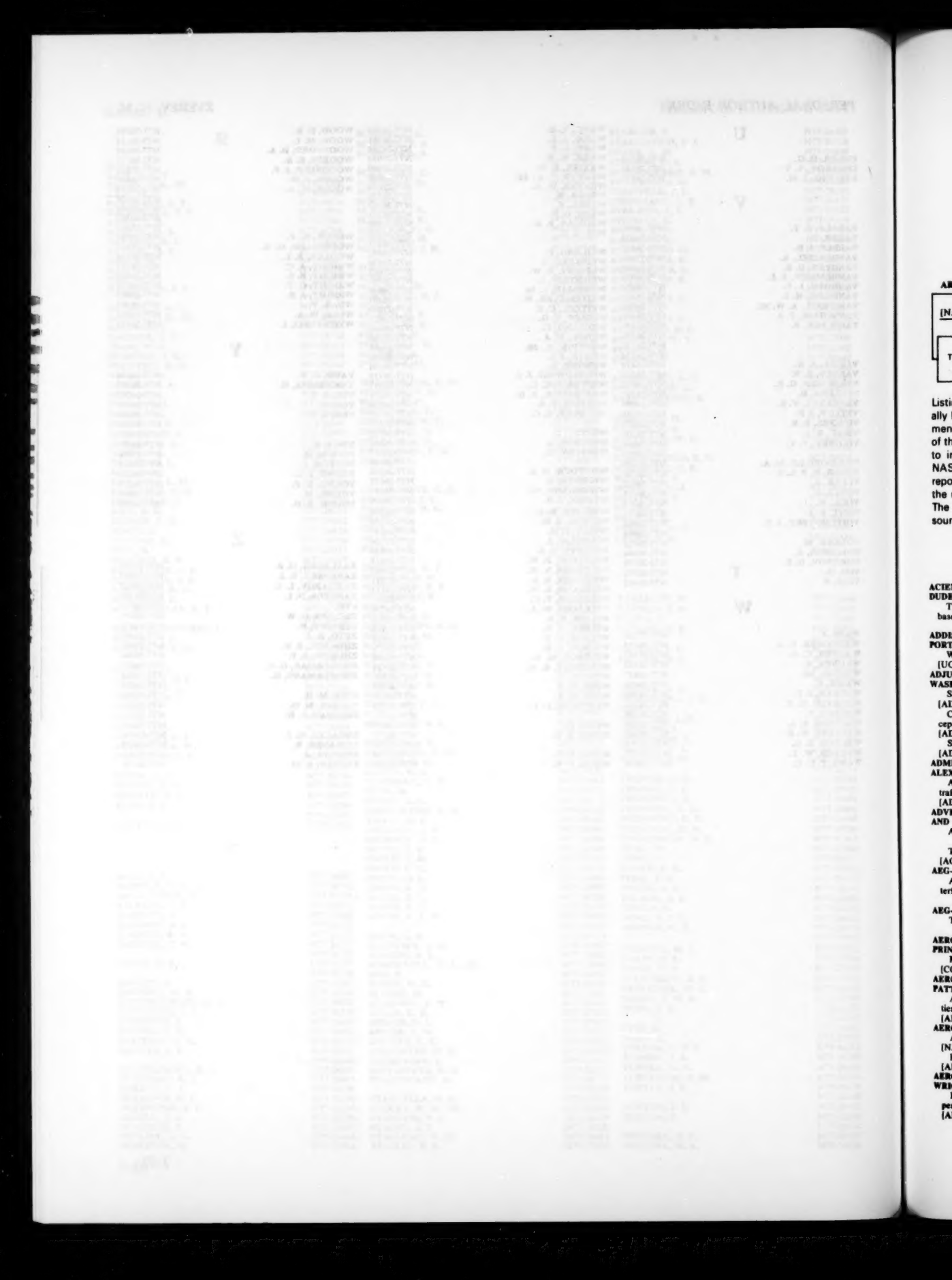
WADE, C. N77-27056
WAGGONER, C. A. N77-26474
WAGNER, C. A. N77-26567
WAGNER, F. N77-26142
WAHLIG, M. N77-26657
WAIDE, C. N77-26666
WALKER, J. P. N77-26501
WALRATH, D. E. N77-26241
WALTER, F. N77-26598
WALTERS, R. A. N77-26799
WALTERS, W. F. N77-26940
WALTON, E. G. N77-26266
WALTON, W. T. N77-26457
WANG, P. C. C. N77-26896
WANG, Y. H. N77-26584
WARD, A. L. N77-26281
WARD, G. F. N77-26784
WARE, W. H. N77-27032
WAXIER, R. M. N77-26960
WEAVER, C. A., JR. N77-26806
WEAVER, W. R. N77-27054
WEBER, H. N77-26526
WEDEL, E. N77-26597
WEED, D. N. N77-26241
WEGMAN, E. J. N77-26899
WEI, K. C. N77-26102
N77-26187
WEILAND, C. N77-26092
WEINBERG, I. N77-26678
WEINERT, R. W. N77-27015
WEINSTEIN, L. N77-26797
WEISSMAN, L. M. N77-26844
WEITEMEYER, W. N77-26207
WEITZEL, C. E. N77-27009
WEIZER, V. G. N77-26621
WELLAND, C. N77-26445
WENDL, M. J. N77-26166
WENTINK, T., JR. N77-26664
WENTZ, J. L. N77-26504
WERNER, U. N77-26329
WESOLOWSKI, J. J. N77-26719
WESTBROOK, C. N77-26517
WESTBROOK, R. D. N77-26671
WESTINE, P. S. N77-26520
WETZLAR, E. C. N77-26115
N77-26117
WHITBY, R. N77-26725
WHITSON, A. N77-26459
WHITTEN, G. N77-26837
N77-26868
WHYTOCK, D. A. N77-26248
WICHNER, R. N77-26652
WIESEMANN, W. N77-26597
WIESEN, J. P. N77-26809
N77-26286
WIESNER, H. J. N77-26538
WILAND, J. H. N77-26347
WILEY, P. H. N77-27034
WILHELM, J. N77-26820
WILLETT, D. S. N77-26675
WILLIAMS, D. W. N77-26442
WILLIAMS, N. M. N77-27011
WILLIAMS, R. A. N77-26113
WILLIAMS, R. W. N77-26335
WILLIAMS, T. C. N77-26738
WILLIAMS, W. J. N77-26850
WILLIE, R. R. N77-26936
WILSEY, N. D. N77-26824
WILSON, G. S. N77-26259
WILSON, R. D. N77-26499
WINDSOR, M. W. N77-26521
WINEHOLT, E. M. N77-26597
WIRTHS, G. N77-26885
WIRZ, H. J. N77-26154
WISE, M. A. N77-26789
WOLTHUIS, O. L. N77-26791
N77-26673
WONG, D. N77-26570
WOOD, B. G. N77-26571
N77-26090
WOOD, C. J. N77-26180
WOOD, D. B. N77-26501
WOOD, D. R. N77-26114
WOOD, M. L. N77-26635
WOODFORD, D. A. N77-26732
WOODIN, E. A. N77-27018
WOODRUFF, J. P. N77-26840
WOODS, J. W. N77-26359
WOODS, W. A. N77-26360
N77-26361
N77-26362
N77-26363
WOODS, W. C. N77-26081
WOODWARD, M. H. N77-26467
WOOLEY, R. L. N77-26516
WRIGHT, A. C. N77-26331
WRIGHT, B. R. N77-26330
WRIGHT, G. F. N77-26178
WRIGHT, J. B. N77-26085
WU, K. Y. N77-26267
WULF, W. A. N77-26833
WYGNANSKI, I. N77-26453

Y

YAHR, G. T. N77-26546
YAMASHINA, H. N77-26903
YEE, S. T. N77-26613
YEH, C. N77-26955
YEH, J. W. N77-26818
N77-27036
N77-27037
YIN, S. K. N77-26079
YOO, M. H. N77-27000
YOST, M. C. N77-26221
YOUNG, J. C. N77-26526
YOUNG, K. P. N77-26273
YOUNG, M. N77-26998
YOUNG, R. D. N77-26560

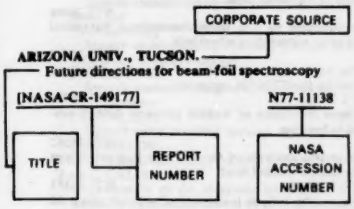
Z

ZAALBERG, O. B. N77-26790
ZABANSKY, B. J. N77-26933
ZAKHAROV, L. E. N77-26967
ZANDERS, D. L. N77-26721
ZEE, C. N77-26714
ZEIDERS, G. W. N77-26478
ZERNIKE, F. N77-26473
ZETO, R. J. N77-26405
ZHDANOV, S. K. N77-26966
ZHUKOV, A. P. N77-26964
ZIMMERMAN, G. G. N77-26877
ZIMMERMANN, H. N77-26858
N77-26859
ZINN, M. H. N77-26391
ZISMAN, M. D. N77-26831
ZITZMAN, L. H. N77-26115
N77-26117
ZORACKI, M. J. N77-26956
ZOWADER, R. N77-26830
ZUBIETA, J. N77-26266
ZVEREV, N. M. N77-26979



CORPORATE SOURCE INDEX

Typical Corporate Source Index Listing



Listings in this index are arranged alphabetically by corporate source. The title of the document provides the user with a brief description of the subject matter. The report number helps to indicate the type of document cited (e.g., NASA report, translation, NASA contractor report). The NASA accession number denotes the number by which the citation is identified. The titles are arranged under each corporate source in ascending accession number order.

A

ACIERIES REUNIES DE BURBACH-EICH-DUDELANGE S. A., LUXEMBOURG.
The grain refinement of electroslag remelted Ni-base alloys
N77-26142

ADDIS TRANSLATIONS INTERNATIONAL, PORTOLA VALLEY, CALIF.
Water as dielectric in high-voltage impulse devices
[UCRL-TRANS-11185] N77-26395

ADJUTANT GENERALS OFFICE [ARMY], WASHINGTON, D. C.
Study of US Army libraries. Volume 2: Directory
[AD-A036002] N77-27028
Computer Output Microforms Program And Concept Study [COMPACS] report
[AD-A035992] N77-27029
Study of US Army libraries, volume 1
[AD-A036004] N77-27033

ADMINISTRATIVE SCIENCES CORP., ALEXANDRIA, VA.
An econometric analysis of enroute and terminal air traffic control
[AD-A036892] N77-26119

ADVISORY GROUP FOR AEROSPACE RESEARCH AND DEVELOPMENT, PARIS [FRANCE].
AGARD highlights 77/1
N77-26074
Task-Oriented Flight Control Systems
[AGARD-LS-89] N77-26161

AEG-TELEFUNKEN, ULM [WEST GERMANY].
Automatic computer controlled operation of the interferometer installation
N77-26212

AEG-TELEFUNKEN, WEDEL [WEST GERMANY].
Technical details of the control and drive systems
N77-26207

AERONAUTICAL RESEARCH ASSOCIATES OF PRINCETON, INC., N. J.
Modeling two-phase flow in a swirl combustor
[COO-4062-2] N77-26432

AERONAUTICAL SYSTEMS DIV., WRIGHT-PATTERSON AFB, OHIO.
Aeronautical systems technology needs. Test facilities and test equipment
[AD-A035252] N77-26171

AEROSPACE CORP., EL SEGUNDO, CALIF.
A study of commuter air service
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[AD-A036083] N77-26812

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[AD-A035275] N77-26496
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[AD-A035294] N77-26948

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[AD-A037526] N77-26559

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[AD-A037754] N77-26475

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[CONS/2551-1] N77-26998
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[ERDA-76-160] N77-26999

AIRESEARCH MFG. CO., PHOENIX, ARIZ.
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[AD-A035701] N77-26141
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N77-26664

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[AD-A037156] N77-26300

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[AD-A037404] N77-26305

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[IS-M-72] N77-26285

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[AD-A037150] N77-26306

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SOURCE

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[AD-A036715] N77-26086
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[AD-A036026] N77-26243

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B

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[AD-A037380] N77-26097
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[AD-A037149] N77-26262
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[AD-A037899] N77-26429
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N77-26443
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N77-26444
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N77-26518
First report on capabilities of dynamic structural analysis by the STRUDL program
[REPT-76-2] N77-26551
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N77-26552
Parametric analysis of the stresses in a cruciform axially loaded welded joint
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Comprehensive aerosol growth model
[BNWL-SA-5931] N77-26706
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[BNWL-2113] N77-26737
Theoretical study of the evolution of mixed phase cumulus clouds
[BNWL-SA-5880] N77-26766
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N77-26210

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N77-26289
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N77-26343
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The electret microphone: A new microphone for telephony
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[BLL-PO-3394-[9022.81]] N77-26346
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[BLL-CE-TRANS-7067-[9022.09]]
N77-26417
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[BLL-RTS-9959] N77-26418
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[BLL-RTS-9956] N77-26419
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[BLL-RTS-10357] N77-26420
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[BLL-RTS-10421] N77-26455
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[BLL-RTS-9748] N77-26511
Calculation of internal weld stresses and weld deformations by means of elasto-plastic finite elements
[BLL-RTS-10440] N77-26530
Approximate method for strength analysis of circular axially symmetric plates of variable thickness, with ribs on one side and subject to an axially symmetric load
[BLL-RTS-10426] N77-26531
Establishment of linear sequences
[BLL-RTS-10323] N77-26903
Concerning the existence of two ferroresonance regimes
[BLL-CE-TRANS-6837-[9022.09]]
N77-26915
Radionuclidic impurities in 99Mo[99m] Tc generators, their measurements and importance
[BLL-RTS-10018] N77-26925
Theory and calculations on non-magnetic confinement of a dense plasma
[BLL-CTO-1291-[9091.9F]] N77-26962
Investigation of plasma confinement in a device with a three-dimensional axis
[BLL-CTO-1286-[9091.9F]] N77-26963
Strong fast-rising magnetic fields in experiments on heating a dense plasma in a rapid theta pinch
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N77-26967
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[BLL-CTO-1282-[9091.9F]] N77-26971
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[BNL-NUREG-50574] N77-26282
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[BNL-21809] N77-26595
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[BNL-50580] N77-26650
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[BNL-21591] N77-26661
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[BNL-21723] N77-26666
Oxidation of sulfur dioxide in power plant plumes
[BNL-21698] N77-26713
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[BNL-21946] N77-26736
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[BNL-20425] N77-26817
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[BNL-21714] N77-26863
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[BNL-21964] N77-26997
Report on the Brookhaven solar neutrino experiment
[BNL-21837] N77-27058
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[AD-A036076] N77-26102
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[AD-A037556] N77-26187
Network pattern processors
[AD-A037129] N77-26871
Applications of pattern theory to problems in computer science
[AD-A037128] N77-26875
BUREAU OF MINES, ALBANY, OREG.
Vapor-pressure measurements by effusion methods
[PB-264295/7] N77-26290
Casting titanium and zirconium in zircon sand molds
[PB-264253/6] N77-26292
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[PB-263952/4] N77-26785
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C

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[CALT-767P4-49] N77-26929
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N77-27049
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Excess noise in selected field-effect transistors
[LBL-5567] N77-26394
Optimizing path printed circuit board router
[UCRL-78564] N77-26408
Numerical methods in hydrodynamic calculations
[UCRL-52112] N77-26430
Instrumentation maintenance
[LBL-5505] N77-26465
Instrumentation calibration
[LBL-5506] N77-26466
Results from circumsolar radiation measurements
[LBL-5292] N77-26657
Hydrocarbons via photosynthesis
[LBL-5387] N77-26658
Computer-based transportable data acquisition and control system
[UCRL-78339] N77-26813
Methodology and planning for a microprocessor-oriented real time controller design automation system
[UCID-17318] N77-26814
Simulation of the performance of a collection of storage space allocation algorithms
[UCID-17251] N77-26834
How to use the CDC 6600 G-machine from a remote terminal
[UCID-30095] N77-26835
TRIX AC: A set of general purpose text editing commands
[UCID-30040[ED.8]] N77-26836
User's guide for the STAR-100
[UCID-30133] N77-26837
Lectures on the new particles
[LBL-5500] N77-26939
Electronic structure of metals and semiconductors: Bulk, surface, and interface properties
[LBL-5493] N77-26992
Resonant Raman scattering in GaSe and GaS[x]Se[1-x]
[LBL-5456] N77-26993
Optical properties of layer compounds Ga s sub x Se sub 1-x
[LBL-5464] N77-26994
Laboratory equipment procurement
[LBL-5504] N77-27022
CALIFORNIA UNIV., IRVINE.
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[AD-A035580] N77-26506
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[AD-A035738] N77-26450
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[UCRL-TRANS-11186] N77-26252
Investigation of the relationship between quasi-global and detailed kinetics mechanisms for the combustion of methane
[UCRL-78424] N77-26255
Electroless-nickel plating of a large turbine rotor for the geothermal program
[UCID-17253] N77-26286
CCD integrated circuit for transient recorders
[UCRL-78360] N77-26398

Approximations for terms related to the kernel in thin-wire integral equations
[AD-A036729] N77-26416
Preliminary analysis and feasibility study on high speed turbulence generator
[UCID-17291] N77-26433
Clinical high-purity germanium gamma-camera
[UCRL-78132] N77-26461
Microsecond holographic interferometer for fracture studies
[UCRL-52161] N77-26462
Application and performance of rare gas oxide amplifiers
[UCRL-78483] N77-26484
Four-D propagation code for high-energy laser beams: A user's manual
[UCID-17217] N77-26485
Compact electron accelerator for pumping gas lasers
[UCRL-78537] N77-26487
Numerical solution of the spray equation
[UCID-17361] N77-26517
Multiple-actuator shaker digital control system
[UCRL-78340] N77-26543
Will a rapidly expanding power-generating system be part of the energy problem or part of its solution
[UCRL-78500] N77-26651
Temperature dependence of the photovoltaic performance of Si cells under blue, white, and near-bandgap irradiation
[UCRL-76203] N77-26652
Monitor of distributed data systems [MODDS]. Part 1: Digest of functional specifications
[UCID-17314-PT-1] N77-26818
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Preliminary documentation of GEARBI: Solution of ODE systems with block-iterative treatment of the Jacobian
[UCID-30149] N77-26839
Two-dimensional delta-mod facsimile coding
[UCRL-77999] N77-26840
User's guide to the Octopus computer network [the SHOC manual]
[UCID-30048-REV-3] N77-26868
Distributed capability computing system
[UCRL-77800] N77-26869
Controlling transactions between distributed computer resources
[UCRL-78282-REV-1] N77-26870
Status of laser fusion
[UCRL-77056] N77-26938
Measurement of the widths of emission lines from laser produced plasmas
[UCRL-78446] N77-26983
KOVEC user's manual
[UCID-17306] N77-27018
Experiment in information sharing: The LLL-Atlanta University Workshops
[UCID-17340] N77-27026
Transportation-related data bases extracted from the national index of energy and environmental data bases. Part 1: Digest of detailed data base descriptions
[UCID-17316-PT-1] N77-27036
Transportation-related data bases extracted from the national index of energy and environmental data bases. Part 2: Detailed data base descriptions
[UCID-17316-PT-2] N77-27037

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[AD-A035579] N77-26316
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[AD-A037764] N77-26887
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[AD-A037482] N77-26901

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[COO-1340-52] N77-26646
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[COO-2868-1] N77-26676
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[AD-A037667] N77-26851
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[AD-A037945] N77-26383
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[NASA-CR-153288] N77-26568
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N77-26202
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N77-26203
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N77-26204
The concept of antenna servocontrol
N77-26206
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N77-26208
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[PB-264476/3] N77-26604
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[AD-A037470] N77-26296
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[COO-2934-76-1] N77-26673
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N77-26598
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[NASA-CR-151419] N77-26532
HOWARD UNIV., WASHINGTON, D.C.
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[NASA-CASE-GSC-12081-2] N77-26796
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[AD-A036870] N77-26298
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[ISL-CO-219/76] N77-26328
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J

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[NASA-CASE-NPO-13550-1] N77-26477
Distributed feedback acoustic surface wave oscillator
[NASA-CASE-NPO-13673-1] N77-26919

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[NASA-CR-150313] N77-26272

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[NASA-TT-F-17447] N77-26152
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[NASA-TT-F-17450] N77-26240
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[NASA-TT-F-17302] N77-26322
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[AD-A038157/4] N77-26114
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[AD-A036982] N77-26188

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[PB-264276/7] N77-26687
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[PB-264277/5] N77-26688
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[PB-264278/3] N77-26689
Environmental considerations of selected energy conserving manufacturing process options. Volume 13: Phosphoric acid industry report
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[LA-UR-76-1413] N77-26279
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[LA-UR-76-2387] N77-26392
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[LA-UR-76-1789] N77-26464
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[LA-UR-76-2294] N77-26649
Aerosol research and development related to health hazards analysis
[LA-6539-PR] N77-26703
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[LA-UR-76-1708] N77-26734
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[LA-UR-76-2097] N77-26798
Biological effects of negative pions
[LA-UR-76-2529] N77-26799
LASL integrated computer network
[LA-UR-76-2321] N77-26865
Computer interfacing at LASL
[LA-UR-76-2502] N77-26866
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[LA-UR-77-59] N77-26940
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[LA-UR-76-1951] N77-26982

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[AD-A037505] N77-26914

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[MIT-2793-5] N77-26251
Machine casting of ferrous alloys
[AD-A035715] N77-26273
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[COO-2923-001] N77-26314
Forward reasoning and dependency-directed backtracking in a system for computer-aided circuit analysis
[AD-A035719] N77-26411
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[AD-A038016] N77-26563

Discrimination of alternative hydrologic regression models: A user's manual
[PB-264285/8] N77-26607
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[AD-A036815] N77-26847
Overview of a linguistic theory of design
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[COO-2487-4] N77-26864
Overview of a linguistic theory of design
[AD-A036977] N77-26876
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[AD-A037972] N77-26913
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[NASA-CR-153267] N77-27051

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[MRL-TN-388] N77-26247

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[MRL-R-680] N77-26881
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[MRL-TN-387] N77-26937

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[AD-A037732] N77-26481
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A social and economic impact study of offshore petroleum and natural gas development in Alaska, phase 2
[PB-264706/3] N77-26693

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Additional degrees of freedom
N77-26166

MCDONNELL-DOUGLAS ASTRONAUTICS CO., HUNTINGTON BEACH, CALIF.
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[AD-A037492] N77-26740
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[AD-A035585] N77-26849

MCDONNELL-DOUGLAS TECHNICAL SERVICES CO., INC., HOUSTON, TEX.
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[NASA-CR-151434] N77-26174
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[NASA-CR-151435] N77-26175
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[NASA-CR-151436] N77-26199

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[NASA-CR-153279] N77-26586

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[AD-A037118] N77-26195
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[AD-A037313] N77-26775
Geographic data base development
[AD-A037116] N77-26823

MITRE CORP., MCLEAN, VA.
Estimation of UG3RD safety benefits
[AD-A036895] N77-26109
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[PB-264447/4] N77-26367
Study of vulnerability of electronic communication systems to electronic interception, volume 2
[PB-264448/2] N77-26368

MONSANTO RESEARCH CORP., DAYTON, OHIO.
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[AD-A035815] N77-26403

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[AD-A035032] N77-26366

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[NASA-CASE-GSC-12046-1] N77-26797
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[NASA-TM-X-71340] N77-26248
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GSFC short pulse radar, JONSWAP-75
[NASA-TN-D-8502] N77-26457
The spectrum of the geoid from altimeter data
[NASA-TM-X-71337] N77-26567
Optimization guide for programs compiled under IBM FORTRAN H [OPT=2]
[NASA-TM-X-71307] N77-26827
Two photon excitation of atomic oxygen
[NASA-TM-X-71344] N77-26926
An integrated circuit floating point accumulator
[NASA-TN-D-8509] N77-27046
OSO-8 X-ray observations of AM Herculis
[NASA-TM-X-71313] N77-27050
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[NASA-TM-X-71341] N77-27056
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[NASA-TM-X-71335] N77-27061

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[NASA-TM-74623] N77-26589
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[NASA-TN-D-8410] N77-26069
Low-speed wind tunnel tests of 1/9-scale model of a variable-sweep supersonic cruise aircraft
[NASA-TN-D-8380] N77-26070
Investigation of real-gas and viscous effects on the aerodynamic characteristics of a 40 deg half-cone with suggested correlations for the shuttle orbiter
[NASA-TN-D-8418] N77-26081
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[NASA-TN-D-8456] N77-26082
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[NASA-TN-D-8478] N77-26083
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[NASA-TN-D-8419] N77-26154
Composite sandwich lattice structure
[NASA-CASE-LAR-11898-2] N77-26242
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[NASA-TM-X-74753] N77-26271
Electro-mechanical sine/cosine generator
[NASA-CASE-LAR-11389-1] N77-26387
Analysis of laser fluorosensor systems for remote algae detection and quantification
[NASA-TN-D-8447] N77-26480
Judgements of relative noisiness of a supersonic transport and several commercial-service aircraft
[NASA-TN-D-8434] N77-26702
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[NASA-TM-X-73622] N77-26136
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[NASA-TM-X-73623] N77-26137
Exploratory investigation of the incipient spinning characteristics of a typical light general aviation airplane
[NASA-TM-X-73671] N77-26153
On-orbit performance of the 12 GHz, 200 watt transmitter experiment package for CTS
[NASA-TM-X-73636] N77-26183

Solar array maximum power tracking with closed-loop control of a 30-centimeter ion thruster
[NASA-TM-X-73643] N77-26222
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[NASA-TM-X-73661] N77-26269
Thermochemical analyses of the oxidative vaporization of metals and oxides by oxygen molecules and atoms
[NASA-TM-X-73682] N77-26270
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[NASA-CASE-LEW-11978-1] N77-26385

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[NASA-TM-X-73669] N77-26612
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New batteries and their impact on electric vehicles
[NASA-TM-X-73672] N77-26614
Preliminary results of accelerated exposure testing of solar cell system components
[NASA-TM-X-73674] N77-26615
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[NASA-TM-X-73676] N77-26616

Evaluation of initial collector field performance at the Langley Solar Building Test Facility
[NASA-TM-X-73677] N77-26617
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[NASA-CP-2010] N77-26618
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In situ measurements of Arctic atmospheric trace constituents from an aircraft
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[AD-A036887] N77-26788
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[AD-A036880] N77-26944
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[AD-A036863] N77-26125
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[AD-A035707] N77-26147
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[AD-A035848] N77-26369
An examination of turbulent dissipation in the marine boundary layer
[AD-A035706] N77-26783
Verification and feasibility study of a micro-computer based ballistics algorithm
[AD-A036062] N77-26846
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[AD-A037718] N77-26309
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[AD-A037717] N77-26452
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[AD-A035391] N77-26494
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[AD-A037143] N77-26951
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[AD-A037184] N77-26295
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O

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[ORNL-5223] N77-26278
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[ORNL/TM-5658] N77-26312
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[CONF-761107-6] N77-26546
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[OUEL-1181/77] N77-26442
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[OUEL-1168/76] N77-26550
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P

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[AD-A037136] N77-26956
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[AD-A037977] N77-26801
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[COO-2721-76-1] N77-26670
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WAND demonstration
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[AD-A037438] N77-26860
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[AD-A037437] N77-26861
An alerting system for a database management system
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[PPPL-1287] N77-26313
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[PPPL-1296] N77-26978
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[AD-A036768] N77-26261
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Q

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[NASA-CR-153265] N77-27052

R

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RENSSELAER POLYTECHNIC INST., TROY, N. Y.
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[AD-A035720] N77-26412
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ROCHESTER UNIV., N. Y.
Materials and mechanics of rate effects in brittle fracture
[COO-2422-08] N77-26541
ROCK ISLAND ARSENAL, ILL.
The effects of sintering parameters and particle size distribution on P/M steel forgings
[AD-A036983] N77-26303
ROCKETDYNE, CANOGA PARK, CALIF.
Advanced thrust chamber technology
[NASA-CR-135221] N77-26221
ROCKETDYNE, MCGREGOR, TEX.
Project DAME: Tactical instrumented missile simulation testing
[AD-A035600] N77-26192
Air Launch Instrumented Vehicles Evaluation [ALIVE]
[AD-A037102] N77-26237
ROCKWELL INTERNATIONAL CORP., ANAHEIM, CALIF.
Investigation of defects and impurities in silicon-on-sapphire
[AD-A037753] N77-27011
ROCKWELL INTERNATIONAL CORP., CANOGA PARK, CALIF.
Inorganic halogen oxidizer research
[AD-A037421] N77-26259
ROCKWELL INTERNATIONAL CORP., CEDAR RAPIDS, IOWA.
High stability temperature compensated crystal oscillator study
[AD-A036908] N77-26415
ROCKWELL INTERNATIONAL CORP., LOS ANGELES, CALIF.
Aerodynamic configuration development of the highly maneuverable aircraft technology remotely piloted research vehicle
[NASA-CR-143841] N77-26076
ROCKWELL INTERNATIONAL CORP., THOUSAND OAKS, CALIF.
Surface study of semiconductor devices
[AD-A037502] N77-26990
ROHDE AND SCHWARTZ, MUNICH [WEST GERMANY].
Antennas and central HF cabling
N77-26209
ROME AIR DEVELOPMENT CENTER, GRIFFISS AFB, N.Y.
Effect of CW-396A radome on the radiation pattern of rectangular antennas
[AD-A036960] N77-26355
Effect of multipath on the height-finding capabilities of a fixed-reflector radar system. Part 3: Effect of radome
[AD-A037957] N77-26356
Th. complete electromagnetic fields in the focal region of a paraboloidal reflector
[AD-A035052] N77-26364
VLF/LF reflectivity of the polar ionosphere, 20 July - 20 September 1975
[AD-A036913] N77-26376
Computational study of long-range high-frequency ionospheric ducting
[AD-A035502] N77-26378
A technical description of the Automated Technical Control [ATEC] system AN/GYM-12-[V]
[AD-A037943] N77-26382
VLF/LF reflectivity of the polar ionosphere, 21 September 1975 - 3 January 1976
[AD-A037794] N77-26748
Synthesis of indium phosphide
[AD-A035507] N77-27002
Electron microscope study of defects in annealed boron implanted silicon
[AD-A037956] N77-27006
ROYAL AIRCRAFT ESTABLISHMENT, FARNBOROUGH [ENGLAND].
Task-Oriented Flight Control Systems: Introduction and overview
N77-26162
Engineering of control systems and implications on control law design
N77-26163
ROYAL NAVAL PERSONNEL RESEARCH COMMITTEE, LONDON [ENGLAND].
A study using infra red thermography of clothing assemblies for use by personnel working beneath operating helicopters
[AD-A035966] N77-26805
ROYAL NETHERLANDS AIRCRAFT FACTORIES FOKKER, SCHIPHOL-OOST.
Exosat thermal distorsions
[FOK-RV-76-56] N77-26548

S

SANDIA LABS., ALBUQUERQUE, N. MEX.
Documentation of the feasibility research on a destructible parachute
[SAND-76-0111] N77-26087
Calculating the ablation of large spheres entering the atmosphere at meteoric velocities
[SAND-76-0311] N77-26178
Application of light-initiated explosive for simulating X-ray blowoff impulse effects on a full scale reentry vehicle
[SAND-76-9019] N77-26189
Unsteady flow and flame propagation in a prechamber of a stratified charge engine
[SAND-75-8743] N77-26250
Effect of temperature on the mechanical properties of uranium
[SAND-76-6038] N77-26276
Calculation of performance parameters of an electroexplosive device using digital data techniques
[SAND-76-0373] N77-26323
Evaluation of an adaptive filter as a digital tracking filter
[SAND-76-5668] N77-26396
Reluctance technique for approximating the performance of large air gap transformers
[SAND-76-0589] N77-26397
VISAR measurements of velocities in explosive valves
[SAND-76-8048] N77-26460
Calculator controlled strain gage data acquisition system
[SAND-76-0146] N77-26467
Acoustical high speed holographic framing camera
[SAND-76-5886] N77-26468
Picosecond and nanosecond Nd: Glass high power laser amplifier system
[SAND-76-0432] N77-26482
Ion plating: Concepts and applications
[SAND-76-5459] N77-26515
Silicon solar cell development for concentrated-sunlight, high-temperature applications
[SAND-76-5311] N77-26647
Analysis of magnetic suspension
[SAND-76-0532] N77-26648
Effects of spectral variations on silicon cell output
[SAND-76-9142] N77-26653
Use of graphics in three dimensional structural analysis of solids
[SAND-76-9188] N77-26815
Accuracy property of certain hyperbolic difference schemes
[SAND-76-0389] N77-26838
Evaluation of a correction method for digital computer lag in hybrid systems
[SAND-76-0343] N77-26867
Cathodoluminescence studies of the 1.4 eV bands in CdTe
[SAND-76-5472] N77-26995
SANDIA LABS., LIVERMORE, CALIF.
Combustion research at Sandia Laboratories
[SAND-76-8511] N77-26253
Equilibrium and transport estimates for hydrogen and helium via Lennard-Jones fluid
[SAND-76-8710] N77-26434
SCHAFER [W. J.] ASSOCIATES, INC., ARLINGTON, VA.
Investigation of possibilities for solar powered high energy lasers in space
[NASA-CR-153271] N77-26478
SCIENCE APPLICATIONS, INC., ANN ARBOR, MICH.
DF laser propagation analysis
[AD-A037813] N77-26501
Thermal imaging systems relative performance: 3-5 micrometers vs 8-12 micrometers
[AD-A037248] N77-26958
SCIENCE APPLICATIONS, INC., HUNTSVILLE, ALA.
NASA software specification and evaluation system: Software verification/validation techniques
[NASA-CR-150299] N77-26828
SCIENCE APPLICATIONS, INC., LOS ANGELES, CALIF.
Parametric study of transport aircraft systems cost and weight
[NASA-CR-151970] N77-26106
SIEMENS A.G., MUNICH [WEST GERMANY].
Software system of the interferometer computer
N77-26213
SIKORSKY AIRCRAFT, STRATFORD, CONN.
Design selection tests for TRAC retraction mechanism
[AD-A037307] N77-26129
SIRA INST. LTD., CHISLEHURST [ENGLAND].
Development study for a high accuracy star sensor. Volume 1: Study and development of an outline concept
[ESA-CR[P]-923-VOL-1] N77-26945
Development study for a high accuracy star sensor. Volume 2: Detailed investigation of preferred concept
[ESA-CR[P]-923-VOL-2] N77-26946
SOUTHAMPTON UNIV. [ENGLAND].
Field emission study
N77-26231
SOUTHEASTERN MASSACHUSETTS UNIV., NORTH DARTMOUTH.
Report of the 1976 Joint Workshop on Pattern Recognition and Artificial Intelligence
[AD-A037503] N77-26878
SOUTHERN ILLINOIS UNIV., EDWARDSVILLE.
Technical and economic evaluation of NOx control for coal-fired cyclone furnaces
[PB-264642/0] N77-26723
SOUTHWEST RESEARCH INST., SAN ANTONIO, TEX.
Biaxial fatigue loading of notched composites
[NASA-CR-145198] N77-26241
Nondestructive evaluation of metal fatigue
[AD-A037672] N77-26299
Engine performance and fire-safety characteristics of water-containing diesel fuels
[AD-A036011] N77-26330
Survey and experimental testing of nongravimetric mass measurement devices
[NASA-CR-151427] N77-26456
Model analysis for penetration of spaced armor
[AD-A035460] N77-26520
SPACE SCIENCES, INC., MONROVIA, CALIF.
A mass spectrometer investigation of the chemistry of plateau burning propellants
[AD-A035602] N77-26332
SPERRY FLIGHT SYSTEMS, PHOENIX, ARIZ.
An evaluation of reaction wheel emitted vibrations for space telescope
[NASA-CR-150303] N77-26181
SPERRY SUPPORT SERVICES, HUNTSVILLE, ALA.
Atmospheric cloud physics thermal systems analysis
[NASA-CR-150312] N77-26753
STANFORD RESEARCH INST., MENLO PARK, CALIF.
An investigation of basic noise properties of field emission
[AD-A037094] N77-26390
Stress-gage system for the megabar [100GPa] range
[AD-A035583] N77-26459
Research on high-energy storage for laser amplifiers
[UCRL-13708] N77-26488
Microwave properties of ice from The Great Lakes
[NASA-CR-135222] N77-26577
ACS. 1: An experimental management tool
[AD-A037311] N77-27023
Research on large file management information systems
[AD-A037161] N77-27024
Technology transfer: Transportation
[NASA-CR-153272] N77-27034
STANFORD UNIV., CALIF.
Maxima of partial samples in Gaussian sequences
[COO-2874-3] N77-26705
Robustness of linear estimators to misspecification of trend
[COO-2874-4] N77-26709
Interpolation of air pollution: A stochastic approach
[COO-2874-11] N77-26710
Levinson- and Chandrasekhar-type equations for a general, discrete-time linear estimation problem
[AD-A037678] N77-26902

STATE UNIV. OF NEW YORK, ALBANY.
Measurements of background hydrocarbons in remote areas
[AD-A037361] N77-26725
SUSSEX UNIV., BRIGHTON [ENGLAND].
Lift, circulation and pressure distributions for a foil oscillating in pitching motion in a perfect fluid
[UFD-1] N77-26422
SYRACUSE UNIV., N. Y.
State-space solution of transient electromagnetic problems
[AD-A037087] N77-26377
Antenna select computer program [ANTSEL]
[AD-A036737] N77-26381
Thinning of a point process over time
[AD-A037491] N77-26894
SYSTEMS CONTROL, INC., PALO ALTO, CALIF.
Model structure determination and test input selection for identification of nonlinear regimes
[AD-A037831] N77-26131
SYSTEMS RESEARCH LABS., INC., DAYTON, OHIO.
A thermal imaging sensor evaluation facility
[AD-A037411] N77-26470
Ion implantation in compound semiconductors
[AD-A037958] N77-27010
SYSTEMS SCIENCE AND SOFTWARE, HAYWARD, CALIF.
Investigation of coupling of field emission cold cathode guns for gas lasers
[AD-A037734] N77-26510

T

TEAGUE [BEN], AUSTIN, TEX.
Effect of temperature on the mechanical properties of uranium
[SAND-76-6038] N77-26276
TECHNION - ISRAEL INST. OF TECH., HAIFA.
The initial roll-up of a thick, two-dimensional wake behind a wing of finite span
[AD-A037033] N77-26104
TECHNISCHE HOGESCHOOL, EINDHOVEN [NETHERLANDS].
On the calculation of permeances and forces between doubly slotted structures
[TH-76-E-65] N77-26400
A numerical model to evaluate the behavior of a regenerative heat exchanger at high temperature
[TH-76-E-66] N77-26439
Experiments with a large sized hollow cathode discharge, part 3
[TH-76-E-67] N77-26986
TEL-AVIV UNIV. [ISRAEL].
The numerical computations of supersonic flow past blunt bodies
[AD-A037665] N77-26105
An experimental method to produce uniform plane stress states with application to fiber reinforced materials
[AD-A037979] N77-26244
Transition in a boundary layer and in a pipe flow
[AD-A037664] N77-26453
TELEDYNE GEOTECHNICAL, ALEXANDRIA, VA.
Evaluation of the Korean short-period array
[AD-A035587] N77-26746
TENNESSEE UNIV., KNOXVILLE.
Feature extraction and recognition of two-dimensional data by the method of moments
[AD-A037445] N77-26879
TEXAS A&M UNIV., COLLEGE STATION.
An experimental investigation of incompressible flow over delta and double-delta wings
[AD-A035380] N77-26101
Demonstration to characterize watershed runoff potential by microwave techniques
[NASA-CR-151426] N77-26579
Proceedings of a workshop on environmental oceanography of the Gulf of Mexico
[ORO-5017-1] N77-26787
Management assistance for Texas city governments. Volume 1: Appendices A-C
[PB-264866/5] N77-27045
TEXAS INSTRUMENTS, INC., DALLAS.
Development of gallium arsenide for infrared windows
[AD-A037336] N77-26957
TEXAS MUNICIPAL LEAGUE, AUSTIN.
Management assistance for Texas city governments. Volume 1: Appendices A-C
[PB-264866/5] N77-27045
TEXAS TRANSPORTATION INST., COLLEGE STATION.
Effects of pavement grooving on friction, braking, and vehicle control
[PB-264665/1] N77-26560
Analytical and experimental assessment of highway impact on air quality
[PB-264590/1] N77-26724
TEXAS UNIV., AUSTIN.
Development and application of operational techniques for the inventory and monitoring of resources and uses for the Texas coastal zone
[E77-10174] N77-26576
Energy and chemical change
[AD-A035695] N77-26927
THERMO ELECTRON CORP., WALTHAM, MASS.
Zirconia-foil compatibility test. Phase 1
[TE-4219-28-77] N77-26645
TORONTO UNIV. [ONTARIO].
Wave motion in low-pressure-ratio rectangular and pyramidal shock tubes
[UTIAS-199] N77-26421
An experimental investigation of the distribution function for the near free molecular parallel plate heat transfer problem
[UTIAS-210] N77-26426
TRANSEMANTICS, INC., WASHINGTON, D.C.
Manual for adjustment and handling of platforms for data collection via satellite [CDCP]
[NASA-TM-75020] N77-26182
TRIANGLE UNIVERSITIES CONSORTIUM ON AIR POLLUTION, CHAPEL HILL, N.C.
International Conference on Photochemical Oxidant Pollution and Its Control. Proceedings, volume 1
[PB-264232/0] N77-26717
International Conference on Photochemical Oxidant Pollution and Its Control. Proceedings, volume 2
[PB-264233/8] N77-26718
TRW DEFENSE AND SPACE SYSTEMS GROUP, REDONDO BEACH, CALIF.
Investigation of beamed energy concepts for propulsion. Volume 1: Systems studies
[AD-A034995] N77-26491
Investigation of beamed energy concepts for propulsion. Volume 2: Laser/propellant coupling analyses
[AD-A035061] N77-26492
TRW, INC., CLEVELAND, OHIO.
Inhibition of hydrogen embrittlement in high strength steel
[AD-A037355] N77-26304
TRW SYSTEMS GROUP, REDONDO BEACH, CALIF.
Measurement techniques for inorganic trace materials in control system streams
[PB-264345/0] N77-26714

U

UNION CARBIDE CORP., TARRYTOWN, N.Y.
Fluorodinitro silicon compounds. Part 1: Organosilicon and silicate esters of 2,2,2-fluorodinitroethanol. Part 2: Nonhydrolyzable silanes
[AD-A037464] N77-26335
UNITED KINGDOM ATOMIC ENERGY AUTHORITY, CULHAM [ENGLAND].
Mechanisms of ion emission from liquid cesium N77-26226
A computer code for thrustor ion optics N77-26228
Computed ion trajectories in thrustor beams N77-26229
UNITED TECHNOLOGIES CORP., SOUTH WINDSOR, CONN.
Energy Conversion Alternatives Study [ECAS], phase 2. Integrated coal gasifier/molten carbonate fuel cell powerplant conceptual design and implementation assessment
[NASA-CR-134955] N77-26637
UNITED TECHNOLOGIES RESEARCH CENTER, EAST HARTFORD, CONN.
Development of directionally solidified eutectic nickel alloys for use in aircraft gas turbines at metal temperatures exceeding 1000 C
[AD-A037246] N77-26150
UNIVERSITIES COUNCIL ON WATER RESOURCES, LINCOLN, NEBR.
Workshop report integrating Water quality and Water and Land Resources Planning
[PB-263476/4] N77-26601
UNIVERSITY OF SOUTHERN CALIF., LOS ANGELES.
Research study in growth of aluminum-nitride on sapphire piezoelectric films
[AD-A037793] N77-26307
Image processing research
[AD-A035315] N77-26947
UNIVERSITY OF SOUTHERN CALIF., MARINA DEL REY.
An assessment of reliability of dialogue annotation instructions
[AD-A037109] N77-26874
UTAH UNIV., SALT LAKE CITY.
Conformational analysis of polymers
[AD-A037092] N77-26317
Application of standard photogeologic techniques to LANDSAT imagery for mineral exploration in the basin and range province of Utah and Nevada
[E77-10170] N77-26572
Geochemistry and hydrothermal alteration at selected Utah hot springs, volume 3
[PB-264415/1] N77-26606
University of Utah direct contact Geothermal Power Project report. A computer program for determining the thermodynamic properties of water
[UTEC-ME-76-171] N77-26642
Impurity effects on the creep of polycrystalline magnesium and aluminum oxides at elevated temperatures
[COO-1591-31] N77-26996

V

VALVO G.M.B.H., HAMBURG [WEST GERMANY].
Development of a klystron for satellite operation in the 12 GHz frequency band
[BMFT-FB-W-76-24] N77-26358
VANDERBILT UNIV., NASHVILLE, TENN.
Nuclear pumped laser II
[NASA-CR-153292] N77-26479
VERMONT UNIV., BURLINGTON.
The structure of a mixed-valence iron fluoride, Fe2F5.2H2O
[AD-A035714] N77-26266
VIRGINIA INST. OF MARINE SCIENCE, GLOUCESTER POINT.
Applications of remote sensing to estuarine management
[NASA-CR-153287] N77-26585
VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG.
A depolarization and attenuation experiment using the CTS satellite
[NASA-CR-152535] N77-26347
Prediction of modulation detectability thresholds for line-scan displays
[AD-A035735] N77-26384
Nonlinear analysis of bonded joints with thermal effects
[NASA-CR-153263] N77-26534
Reliability study of SINGER. Volume 1: Validation of model
[AD-A037819] N77-26561
An experimental study of the atmospheric boundary layer modified by a change in surface roughness and surface temperature
[NASA-CR-141422] N77-26730
VIRGINIA UNIV., CHARLOTTESVILLE.
Cryogenic instrumentation
[AD-A037133] N77-26476
Transient response of continuous elastic structures
[AD-A037001] N77-26565
Analysis of thermal performance of Solaris water-trickle solar collector
[CONF-761107-17] N77-26668
Evaluation of Solaris water-trickle solar collector and demonstration of annual cycle collection and storage of solar heated water
[CONF-761143-1] N77-26669
Classification of coastal environments
[AD-A036770] N77-26750
Mathematical investigations of dynamical systems
[AD-A036771] N77-26895
VON KARMAN INST. FOR FLUID DYNAMICS, RHODE-SAINT-GENESE [BELGIUM].
An implicit, compact, finite difference method to solve hyperbolic equations
[VKI-TN-119] N77-26885

W

WASHINGTON STATE UNIV., PULLMAN.
Electroinitiated polymerization of monomers on metal electrodes
[AD-A036989] N77-26321
Crystal violet as a mode-locker of the rhodamine 6G dye laser
[AD-A037643] N77-26499
WASHINGTON UNIV., SEATTLE.
Interference seals and connectors for undersea electrical applications
[AD-A036841] N77-26522
Nonlinear optimization and generalized Lagrange multipliers
[AD-A037560] N77-26852
Integral functionals, normal integrands and measurable selections
[AD-A037561] N77-26882
WASHINGTON UNIV., ST. LOUIS, MO.
Unsteady hovering wake parameters identified from dynamic model tests, part 1
[NASA-CR-152022] N77-26077
Application of system identification to analytic rotor modeling from simulated and wind tunnel dynamic test data, part 2
[NASA-CR-152023] N77-26078
Finite element stability analysis for coupled rotor and support systems
[NASA-CR-152024] N77-26079
WATERVLIET ARSENAL, N.Y.
Computer controlled X-ray stress analysis for inspection of manufactured components
[AD-A037350] N77-26529
The stability of a beam subjected to a moving mass
[AD-A037719] N77-26566

The influence of support characteristics on the stability of an elastic system subjected to a circulatory force
[AD-A037929] N77-26918

WAYNE STATE UNIV., DETROIT, MICH.
Radiolysis studies on reactive intermediates
[COO-2086-87] N77-26930

WEAPONS RESEARCH ESTABLISHMENT, SALISBURY [AUSTRALIA].
Estimation at subsonic speeds of the longitudinal and lateral aerodynamic characteristics of wing-body combinations at angles up to 90 deg
[WRE-REPT-1672(WR/D)] N77-26080

WEIDLINGER ASSOCIATES, NEW YORK.
Note on the dynamic buckling of elasto-plastic structures
[AD-A035964] N77-26536
Numerical analysis of the dynamic response of elasto-plastic shells
[AD-A035965] N77-26537

WELLESLEY INSTRUMENTS CORP., WALTHAM, MASS.
A dual electro-optical light image receiver and recorder
[AD-A037955] N77-26745

WESTINGHOUSE DEFENSE AND ELECTRONIC SYSTEMS CENTER, BALTIMORE, MD.
Cavity dump-PTM Nd:laser
[AD-A037193] N77-26504

WESTINGHOUSE ELECTRIC CORP., CHESWICK, PA.
Design and development of a segmented magnet homopolar torque converter
[AD-A037259] N77-26149

WESTINGHOUSE ELECTRIC CORP., PITTSBURGH, PA.
Irradiated dynamic fracture toughness of ASTM A533 grade B, class 1 steel plate and submerged arc weldment
[ORNL/SUB-3720-1] N77-26274
Microstructure and mechanical properties of product from extrusion-consolidated 7075 Al prealloyed powder
[AD-A037188] N77-26301

WESTINGHOUSE RESEARCH LABS., PITTSBURGH, PA.
Energy Conversion Alternatives Study [ECAS], Phase 2. Volume 1: Summary and combined gas-stream turbine plant with an integrated low-BTU gasifier
[NASA-CR-134942-VOL-1] N77-26628
Energy Conversion Alternatives Study [ECAS], Phase 2. Volume 2: Summary and combined gas-steam turbine plant using coal derived liquid fuel
[NASA-CR-134942-VOL-2] N77-26629
Energy Conversion Alternatives Study [ECAS], Phase 2. Volume 3: Summary and advanced steam plant with pressurized fluidized bed boilers
[NASA-CR-134942-VOL-3] N77-26630
Evaluation of sulfosalts
[AD-A037946] N77-27015

WESTON OBSERVATORY, MASS.
Investigation of magnetic field phenomena in the ionosphere
[AD-A037541] N77-26731

WIEN UNIV. [AUSTRIA].
Stability and thermal effects of field ion emitters
N77-26230

WISCONSIN UNIV., MADISON.
Inelastic molecular collisions: Applications of theoretical methods to problems in relaxation phenomena and laser operation
[TID-27235] N77-26928
Calculation of monthly average insolation on tilted surfaces
[CONF-760842-15] N77-27057

WORCESTER POLYTECHNIC INST., MASS.
Non-linear optical amplification and absorption
[AD-A037103] N77-26954

WORLD METEOROLOGICAL ORGANIZATION, GENEVA [SWITZERLAND].
Statistical information on activities in operational hydrology
[WMO-464] N77-26599
Scientific lectures on meteorology
[WMO-435] N77-26754
Meteorology and hydrology in aid of food production
N77-26755
Use of crop-weather models for assessing potential agricultural production
[REPT-891] N77-26756
The influence of space techniques on the development of meteorology
N77-26758
Towards a global operational system of meteorological satellites
N77-26759
World Weather Watch. Consolidated report on the voluntary assistance programme including projects approved for circulation in 1976
[WMO-465] N77-26774
Weather, climate and human settlements
[WMO-448] N77-27038

WYLE LABS., INC., HUNTSVILLE, ALA.
Assembly and testing of a 1.8 by 3.7 meter Fresnel lens solar concentrator
[NASA-CR-150300] N77-26610
Personal flotation devices research, phase 1
[AD-A037221] N77-26810

X

XONICS, INC., VAN NUYS, CALIF.
Research on crystal chemistry studies
[AD-A035478] N77-27001

Y

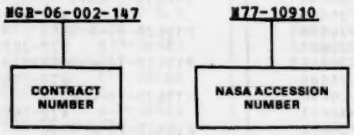
YALE UNIV., NEW HAVEN, CONN.
The development of a parallel-channel spectrographic detector: Applications to Raman scattering
[AD-A037407] N77-26265

YESHIVA UNIV., NEW YORK.
Electronic energy levels in imperfect solids
[AD-A035723] N77-27017

Z

ZEPPELIN-METALLWERKE G.M.B.H., FRIEDRICHSHAFEN [WEST GERMANY].
Construction details of the interferometer rotary drive
N77-26205

Typical Contract Number Index Listing



Listings in this index are arranged alphanumerically by contract number. Under each contract number the NASA accession numbers denoting documents that have been produced as a result of research done under that contract are arranged in ascending order. The NASA accession number denotes the number by which the citation is identified.

AF PROJ. 6368
N77-26195
AF PROJ. 1121
N77-26821
AF PROJ. 1209
N77-26374
AF PROJ. 1368
N77-26564
AF PROJ. 1426
N77-26935
AF PROJ. 1472
N77-26900
AF PROJ. 1926
N77-26935
AF PROJ. 2004
N77-26470
N77-26958
AF PROJ. 2304
N77-26472
N77-26913
AF PROJ. 2306
N77-27006
AF PROJ. 2307
N77-26299
AF PROJ. 2311
N77-27062
AF PROJ. 2826
N77-27013
AF PROJ. 3058
N77-26331
AF PROJ. 3763
N77-26416
AF PROJ. 4519
N77-26370
N77-26371
N77-26372
N77-26373
AF PROJ. 4540
N77-26406
AF PROJ. 4603
N77-26365
AF PROJ. 5620
N77-27002
AF PROJ. 6512
N77-26217
AF PROJ. 6813
N77-26450
AF PROJ. 7071
N77-26901
AF PROJ. 7222
N77-26812
AF PROJ. 7351
N77-26295
N77-26300
AF PROJ. 7600
N77-26745
AF PROJ. 7885
N77-27008
N77-27010
AF PROJ. 9567
N77-26381
AF PROJ. 9711
N77-26334
AF PROJ. 9751
N77-26375
N77-26740
AF PROJ. 9769
N77-26880
AF PROJ. 9781
N77-26104
N77-26105
N77-26450
N77-26453
AF PROJ. 9782
N77-26244
N77-26299
N77-26562
N77-26563
AF-AFOSR-2091-71
N77-26426
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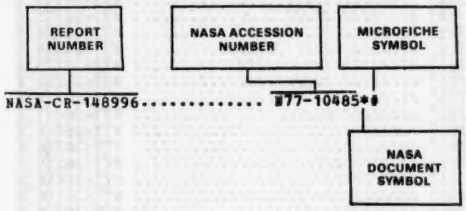
N00014-75-C-0344 N77-26990
N00014-75-C-0374 N77-26565
N00014-75-C-0461 N77-26871 N77-26875
N00014-75-C-0462 N77-26830 N77-26831 N77-26832 N77-26860 N77-26861 N77-26862
N00014-75-C-0480 N77-26750
N00014-75-C-0499 N77-26263
N00014-75-C-0512 N77-26824
N00014-75-C-0533 N77-26359 N77-26360 N77-26361 N77-26362 N77-26363
N00014-75-C-0535 N77-26499
N00014-75-C-0545 N77-26879
N00014-75-C-0643 N77-26411 N77-26847 N77-26848 N77-26876
N00014-75-C-0710 N77-26874
N00014-75-C-0756 N77-26266

N00014-75-C-0791 N77-26335
N00014-75-C-0799 N77-26305
N00014-75-C-0813 N77-26506
N00014-75-C-0942 N77-26258
N00014-75-C-0955 N77-26318
N00014-75-C-0986 N77-26332
N00014-75-C-1143 N77-26261
N00014-75-C-1172 N77-26073
N00014-76-C-0016 N77-26739
N00014-76-C-0073 N77-26895
N00014-76-C-0283 N77-26725
N00014-76-C-0441 N77-26473
N00014-76-C-0643 N77-26265
N00014-76-C-0690 N77-27017
N00014-76-C-0731 N77-26094
N00014-76-C-0976 N77-27007
N00014-76-C-1057 N77-26741
N00014-76-F-0004 N77-27004
N00014-76-T-C-0817 N77-26264
N00014-77-C-0004 N77-26389
N00017-72-C-4401 N77-26196
N00017-73-C-2244 N77-26883
N00017-74-C-1208 N77-26522
N00024-76-C-6126 N77-26809
N00123-73-C-1192 N77-26955
N00123-76-C-1321 N77-26961
N00173-76-C-0102 N77-26501
N00228-75-C-2378 N77-26747
N60530-75-M-5630 N77-26186
N60530-76-C-0121 N77-26325
N61339-74-C-0152 N77-26260
N61339-75-C-0099 N77-26803
N62269-75-C-0359 N77-26143
N62269-75-C-0425 N77-26513
N62269-76-C-0107 N77-26150
N68335-76-C-3387 N77-26172
PO-WA-76-4939 N77-26999
PROJ. SQUID N77-26261
PROJ. 38 N77-26981
RR0110941 N77-26452 N77-26505
RR0420601 N77-26874
SP43421202 N77-26338
SRI PROJ. PYU-3159 N77-26488
SRI PROJ. 3571 N77-26577
SRI PROJ. 3670 N77-27034
SWRI PROJ. 15-416 N77-26299
SWRI PROJ. 16-4498 N77-26456
TP-6AC039 N77-26367 N77-26368
W-31-109-ENG-38 N77-26284 N77-26393 N77-26540 N77-26544 N77-26707 N77-26708 N77-26933 N77-26984
W-7405-ENG-26 N77-26274 N77-26278 N77-26435 N77-26542 N77-26545 N77-26546 N77-26659 N77-26662 N77-26671 N77-26816 N77-26884 N77-26932 N77-27000
W-7405-ENG-36 N77-26279 N77-26280 N77-26392 N77-26464 N77-26649 N77-26703 N77-26734 N77-26798 N77-26799 N77-26865 N77-26866 N77-26940 N77-26982
W-7405-ENG-48 N77-26255 N77-26286 N77-26394 N77-26398 N77-26408 N77-26430 N77-26433 N77-26461 N77-26462 N77-26465 N77-26466 N77-26484 N77-26485 N77-26487 N77-26517 N77-26543 N77-26651 N77-26652 N77-26657 N77-26658 N77-26813 N77-26814 N77-26818 N77-26819 N77-26834 N77-26835 N77-26836 N77-26837 N77-26839 N77-26840 N77-26868 N77-26869 N77-26870 N77-26938 N77-26939 N77-26977 N77-26983 N77-26992 N77-26993 N77-26994 N77-27018 N77-27022 N77-27026 N77-27036 N77-27037
W-7405-ENG-82 N77-26285
W-7405-ENG-92 N77-26324 N77-26663
WF54592201 N77-26150
XF21211001 N77-26872
XF21211002 N77-26872
161-03-02 N77-26457
176-20-32-07 N77-26480
185-50-51-01 N77-27054
197-10 N77-26701
505-03-11-01 N77-26920
505-06-12-07 N77-26533
505-09-11-01 N77-26702
505-09-31-01 N77-26154
505-10-21-05 N77-26082
505-10-22 N77-26067 N77-26068
505-11-16-08 N77-26083
505-11-31-02 N77-26081
513-53-05 N77-26111
723-01-01 N77-26076
743-01-13-01 N77-26897
743-04-12-02 N77-26069 N77-26070
862-11-01 N77-27046
992-23-10 N77-27063

Typical Report/Accession Number Index Listing



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A-6924 ..... N77-26111*#
A-7047 ..... N77-26067*#
A-7048 ..... N77-27063*#
A-7063 ..... N77-26068*#
A-7076 ..... N77-26533*#

AD-A03593 ..... N77-26354 #
AD-A033498 ..... N77-26446 #
AD-A033658 ..... N77-26217 #
AD-A034995 ..... N77-26491 #
AD-A035031 ..... N77-26950 #
AD-A035032 ..... N77-26366 #
AD-A035036 ..... N77-26497 #
AD-A035039 ..... N77-26949 #
AD-A035040 ..... N77-26495 #
AD-A035052 ..... N77-26364 #
AD-A035061 ..... N77-26492 #
AD-A035143 ..... N77-26519 #
AD-A035165 ..... N77-26359 #
AD-A035166 ..... N77-26360 #
AD-A035167 ..... N77-26361 #
AD-A035245 ..... N77-26988 #
AD-A035246 ..... N77-26404 #
AD-A035252 ..... N77-26171 #
AD-A035254 ..... N77-26447 #
AD-A035266 ..... N77-26405 #
AD-A035275 ..... N77-26496 #
AD-A035277 ..... N77-26362 #
AD-A035278 ..... N77-26363 #
AD-A035294 ..... N77-26948 #
AD-A035315 ..... N77-26947 #
AD-A035380 ..... N77-26101 #
AD-A035391 ..... N77-26494 #
AD-A035460 ..... N77-26520 #
AD-A035478 ..... N77-27001 #
AD-A035487 ..... N77-26833 #
AD-A035502 ..... N77-26378 #
AD-A035505 ..... N77-26085 #
AD-A035506 ..... N77-26185 #
AD-A035507 ..... N77-27002 #
AD-A035510 ..... N77-26365 #
AD-A035513 ..... N77-26493 #
AD-A035565 ..... N77-26143 #
AD-A035566 ..... N77-26144 #
AD-A035579 ..... N77-26316 #
AD-A035580 ..... N77-26506 #
AD-A035583 ..... N77-26459 #
AD-A035584 ..... N77-26257 #
AD-A035585 ..... N77-26849 #
AD-A035587 ..... N77-26746 #
AD-A035593 ..... N77-26379 #
AD-A035594 ..... N77-26489 #
AD-A035600 ..... N77-26192 #
AD-A035601 ..... N77-26072 #
AD-A035602 ..... N77-26332 #
AD-A035603 ..... N77-26898 #
AD-A035604 ..... N77-26409 #
AD-A035605 ..... N77-26505 #
AD-A035639 ..... N77-26256 #
AD-A035642 ..... N77-26410 #
AD-A035643 ..... N77-26955 #
AD-A035651 ..... N77-26760 #
AD-A035674 ..... N77-26521 #
AD-A035683 ..... N77-26132 #
AD-A035695 ..... N77-26927 #
AD-A035701 ..... N77-26141 #
AD-A035706 ..... N77-26783 #
AD-A035707 ..... N77-26147 #
AD-A035711 ..... N77-26744 #
AD-A035712 ..... N77-26449 #
AD-A035713 ..... N77-26896 #
AD-A035714 ..... N77-26266 #
AD-A035715 ..... N77-26273 #
AD-A035719 ..... N77-26411 #
AD-A035720 ..... N77-26412 #
AD-A035722 ..... N77-26700 #
AD-A035723 ..... N77-27017 #
AD-A035724 ..... N77-26451 #
AD-A035731 ..... N77-26821 #
AD-A035733 ..... N77-26850 #
AD-A035735 ..... N77-26384 #
AD-A035737 ..... N77-26073 #
AD-A035738 ..... N77-26450 #
AD-A035739 ..... N77-26899 #
AD-A035815 ..... N77-26403 #
AD-A035848 ..... N77-26369 #
AD-A035855 ..... N77-26406 #
AD-A035908 ..... N77-26338 #
AD-A035948 ..... N77-26291 #
AD-A035949 ..... N77-26350 #
AD-A035950 ..... N77-26351 #
AD-A035951 ..... N77-26352 #
AD-A035952 ..... N77-26353 #
AD-A035960 ..... N77-26523 #
AD-A035961 ..... N77-26123 #
AD-A035964 ..... N77-26536 #
AD-A035965 ..... N77-26537 #
AD-A035966 ..... N77-26805 #
AD-A035970 ..... N77-26389 #
AD-A035992 ..... N77-27029 #
AD-A035994 ..... N77-26923 #
AD-A035999 ..... N77-26260 #
AD-A036000 ..... N77-26526 #
AD-A036002 ..... N77-27028 #
AD-A036004 ..... N77-27033 #
AD-A036011 ..... N77-26330 #
AD-A036026 ..... N77-26243 #
AD-A036027 ..... N77-26407 #
AD-A036062 ..... N77-26846 #
AD-A036073 ..... N77-26333 #
AD-A036076 ..... N77-26102 #
AD-A036082 ..... N77-26319 #
AD-A036083 ..... N77-26812 #
AD-A036715 ..... N77-26086 #
AD-A036729 ..... N77-26416 #
AD-A036736 ..... N77-26310 #
AD-A036737 ..... N77-26381 #
AD-A036741 ..... N77-26331 #
AD-A036768 ..... N77-26261 #
AD-A036770 ..... N77-26750 #
AD-A036771 ..... N77-26895 #
AD-A036774 ..... N77-26118 #
AD-A036785 ..... N77-26128 #
AD-A036815 ..... N77-26847 #
AD-A036841 ..... N77-26522 #
AD-A036863 ..... N77-26125 #
AD-A036870 ..... N77-26298 #
AD-A036871 ..... N77-26959 #
AD-A036872 ..... N77-26500 #
AD-A036873 ..... N77-26370 #
AD-A036874 ..... N77-26371 #
AD-A036876 ..... N77-26448 #
AD-A036879 ..... N77-26953 #
AD-A036880 ..... N77-26944 #
AD-A036887 ..... N77-26788 #
AD-A036892 ..... N77-26119 #
AD-A036895 ..... N77-26109 #

AD-A036900 ..... N77-26100 #
AD-A036904 ..... N77-26236 #
AD-A036908 ..... N77-26415 #
AD-A036913 ..... N77-26376 #
AD-A036915 ..... N77-26848 #
AD-A036916 ..... N77-26989 #
AD-A036918 ..... N77-26294 #
AD-A036936 ..... N77-26696 #
AD-A036959 ..... N77-26339 #
AD-A036960 ..... N77-26355 #
AD-A036975 ..... N77-26883 #
AD-A036977 ..... N77-26876 #
AD-A036982 ..... N77-26188 #
AD-A036983 ..... N77-26303 #
AD-A036984 ..... N77-26263 #
AD-A036988 ..... N77-26640 #
AD-A036989 ..... N77-26321 #
AD-A036991 ..... N77-26264 #
AD-A036992 ..... N77-27062 #
AD-A036994 ..... N77-26936 #
AD-A036999 ..... N77-26374 #
AD-A037001 ..... N77-26565 #
AD-A037002 ..... N77-26180 #
AD-A037008 ..... N77-26749 #
AD-A037011 ..... N77-26513 #
AD-A037033 ..... N77-26104 #
AD-A037047 ..... N77-26302 #
AD-A037062 ..... N77-26095 #
AD-A037067 ..... N77-26186 #
AD-A037072 ..... N77-26743 #
AD-A037077 ..... N77-26160 #
AD-A037082 ..... N77-26380 #
AD-A037086 ..... N77-26820 #
AD-A037087 ..... N77-26377 #
AD-A037092 ..... N77-26317 #
AD-A037094 ..... N77-26390 #
AD-A037102 ..... N77-26237 #
AD-A037103 ..... N77-26954 #
AD-A037105 ..... N77-27003 #
AD-A037109 ..... N77-26874 #
AD-A037116 ..... N77-26823 #
AD-A037118 ..... N77-26195 #
AD-A037128 ..... N77-26875 #
AD-A037129 ..... N77-26871 #
AD-A037133 ..... N77-26476 #
AD-A037134 ..... N77-26179 #
AD-A037136 ..... N77-26956 #
AD-A037138 ..... N77-26391 #
AD-A037142 ..... N77-26952 #
AD-A037143 ..... N77-26951 #
AD-A037146 ..... N77-26872 #
AD-A037149 ..... N77-26262 #
AD-A037150 ..... N77-26306 #
AD-A037151 ..... N77-26893 #
AD-A037156 ..... N77-26300 #
AD-A037157 ..... N77-26200 #
AD-A037158 ..... N77-26373 #
AD-A037159 ..... N77-26372 #
AD-A037161 ..... N77-27024 #
AD-A037184 ..... N77-26295 #
AD-A037185 ..... N77-27005 #
AD-A037188 ..... N77-26301 #
AD-A037190 ..... N77-26824 #
AD-A037191 ..... N77-26609 #
AD-A037193 ..... N77-26504 #
AD-A037195 ..... N77-26133 #
AD-A037196 ..... N77-26127 #
AD-A037197 ..... N77-26935 #
AD-A037199 ..... N77-26832 #
AD-A037201 ..... N77-26862 #
AD-A037211 ..... N77-26886 #
AD-A037215 ..... N77-26694 #
AD-A037216 ..... N77-26695 #
AD-A037221 ..... N77-26810 #
AD-A037226 ..... N77-26853 #
AD-A037238 ..... N77-26414 #
AD-A037240 ..... N77-26318 #
AD-A037243 ..... N77-27007*#
AD-A037246 ..... N77-26150 #
AD-A037248 ..... N77-26958 #
AD-A037250 ..... N77-26741 #
AD-A037252 ..... N77-26238 #
AD-A037257 ..... N77-26961 #
AD-A037259 ..... N77-26149 #
AD-A037300 ..... N77-26591 #
AD-A037303 ..... N77-26311 #
AD-A037305 ..... N77-26739*#
AD-A037307 ..... N77-26129 #
AD-A037311 ..... N77-27023 #
AD-A037313 ..... N77-26775 #
AD-A037335 ..... N77-26831 #
AD-A037336 ..... N77-26957 #
AD-A037341 ..... N77-26469 #
AD-A037344 ..... N77-26293 #
AD-A037349 ..... N77-26151 #
AD-A037350 ..... N77-26529 #
AD-A037352 ..... N77-26145 #
AD-A037353 ..... N77-26375 #
AD-A037355 ..... N77-26304 #
AD-A037356 ..... N77-26084 #
AD-A037361 ..... N77-26725 #
AD-A037362 ..... N77-26258 #
AD-A037375 ..... N77-26738 #
AD-A037380 ..... N77-26097 #
AD-A037381 ..... N77-26608 #
AD-A037383 ..... N77-26336 #
AD-A037385 ..... N77-26239 #
AD-A037393 ..... N77-26498 #
AD-A037398 ..... N77-26196 #
AD-A037404 ..... N77-26305 #
AD-A037405 ..... N77-26747 #
AD-A037407 ..... N77-26265 #
AD-A037410 ..... N77-26822 #
AD-A037411 ..... N77-26470 #
AD-A037412 ..... N77-26471 #
AD-A037419 ..... N77-26094 #
AD-A037421 ..... N77-26259 #
AD-A037426 ..... N77-26539 #
AD-A037436 ..... N77-26830 #
AD-A037437 ..... N77-26861 #
AD-A037438 ..... N77-26860 #
AD-A037445 ..... N77-26879 #
AD-A037446 ..... N77-26528 #
AD-A037450 ..... N77-26427 #
AD-A037464 ..... N77-26335 #
AD-A037468 ..... N77-26803 #
AD-A037470 ..... N77-26296 #
AD-A037471 ..... N77-26454 #
AD-A037479 ..... N77-26120 #
AD-A037482 ..... N77-26901 #
AD-A037483 ..... N77-26900 #
AD-A037489 ..... N77-26564 #
AD-A037491 ..... N77-26894 #
AD-A037492 ..... N77-26740 #
AD-A037498 ..... N77-26800 #
AD-A037502 ..... N77-26990 #
AD-A037503 ..... N77-26878 #
AD-A037504 ..... N77-26891 #
AD-A037505 ..... N77-26914 #
AD-A037525 ..... N77-26960 #
AD-A037526 ..... N77-26559 #
AD-A037527 ..... N77-26297 #
AD-A037532 ..... N77-26103 #
AD-A037535 ..... N77-26811 #
AD-A037540 ..... N77-26098 #
AD-A037541 ..... N77-26731 #
AD-A037548 ..... N77-26096 #
AD-A037556 ..... N77-26187 #
AD-A037559 ..... N77-26888 #
AD-A037560 ..... N77-26852 #
AD-A037561 ..... N77-26882 #
AD-A037563 ..... N77-26502 #
AD-A037564 ..... N77-26826 #
AD-A037584 ..... N77-26428 #
AD-A037586 ..... N77-26641 #
AD-A037593 ..... N77-26218 #
AD-A037604 ..... N77-26245 #
AD-A037606 ..... N77-27004 #
AD-A037611 ..... N77-26524 #
AD-A037612 ..... N77-26825 #
AD-A037615 ..... N77-26508 #
AD-A037617 ..... N77-26507 #
AD-A037618 ..... N77-26538 #
AD-A037621 ..... N77-26130 #
AD-A037632 ..... N77-26809 #
AD-A037638 ..... N77-26845 #
AD-A037639 ..... N77-26844 #
AD-A037643 ..... N77-26499 #
AD-A037660 ..... N77-26762 #
AD-A037661 ..... N77-26761 #
AD-A037664 ..... N77-26453 #
AD-A037665 ..... N77-26105 #
AD-A037667 ..... N77-26851 #
AD-A037671 ..... N77-26889 #
AD-A037672 ..... N77-26299 #
AD-A037673 ..... N77-26562 #
AD-A037675 ..... N77-26194 #
AD-A037678 ..... N77-26902 #

AD-A037686 ..... N77-26535 #
AD-A037687 ..... N77-26173 #
AD-A037688 ..... N77-26158 #
AD-A037689 ..... N77-26159 #
AD-A037694 ..... N77-26146 #
AD-A037717 ..... N77-26452 #
AD-A037718 ..... N77-26309 #
AD-A037719 ..... N77-26566 #
AD-A037732 ..... N77-26481 #
AD-A037734 ..... N77-26510 #
AD-A037735 ..... N77-26093 #
AD-A037738 ..... N77-27031 #
AD-A037745 ..... N77-26234 #
AD-A037748 ..... N77-26235 #
AD-A037752 ..... N77-27009 #
AD-A037753 ..... N77-27011 #
AD-A037754 ..... N77-26475 #
AD-A037755 ..... N77-26357 #
AD-A037756 ..... N77-26193 #
AD-A037758 ..... N77-27025 #
AD-A037760 ..... N77-26413 #
AD-A037764 ..... N77-26887 #
AD-A037772 ..... N77-26472 #
AD-A037774 ..... N77-26509 #
AD-A037775 ..... N77-26807 #
AD-A037793 ..... N77-26307 #
AD-A037794 ..... N77-26748 #
AD-A037795 ..... N77-27014 #
AD-A037796 ..... N77-27013 #
AD-A037797 ..... N77-27008 #
AD-A037803 ..... N77-26172 #
AD-A037813 ..... N77-26501 #
AD-A037819 ..... N77-26561 #
AD-A037820 ..... N77-26890 #
AD-A037831 ..... N77-26131 #
AD-A037832 ..... N77-26473 #
AD-A037837 ..... N77-26071 #
AD-A037839 ..... N77-26169 #
AD-A037896 ..... N77-27032 #
AD-A037899 ..... N77-26429 #
AD-A037901 ..... N77-26126 #
AD-A037917 ..... N77-27030 #
AD-A037929 ..... N77-26918 #
AD-A037934 ..... N77-26782 #
AD-A037935 ..... N77-26764 #
AD-A037936 ..... N77-26781 #
AD-A037937 ..... N77-26780 #
AD-A037938 ..... N77-26779 #
AD-A037939 ..... N77-26778 #
AD-A037940 ..... N77-26777 #
AD-A037941 ..... N77-26763 #
AD-A037943 ..... N77-26382 #
AD-A037944 ..... N77-26808 #
AD-A037945 ..... N77-26383 #
AD-A037946 ..... N77-27015 #
AD-A037948 ..... N77-27012 #
AD-A037950 ..... N77-27016 #
AD-A037952 ..... N77-26474 #
AD-A037954 ..... N77-26776 #
AD-A037955 ..... N77-26745 #
AD-A037956 ..... N77-27006 #
AD-A037957 ..... N77-26356 #
AD-A037958 ..... N77-27010 #
AD-A037959 ..... N77-26216 #
AD-A037961 ..... N77-26765 #
AD-A037963 ..... N77-26751 #
AD-A037968 ..... N77-26880 #
AD-A037969 ..... N77-26527 #
AD-A037971 ..... N77-26892 #
AD-A037972 ..... N77-26913 #
AD-A037976 ..... N77-26334 #
AD-A037977 ..... N77-26801 #
AD-A037979 ..... N77-26244 #
AD-A037985 ..... N77-26525 #
AD-A037992 ..... N77-26806 #
AD-A037993 ..... N77-26877 #
AD-A038006 ..... N77-26802 #
AD-A038013 ..... N77-26503 #
AD-A038016 ..... N77-26563 #
AD-A038028 ..... N77-26320 #
AD-A038029 ..... N77-26099 #
AD-A038032 ..... N77-26742 #
AD-A038116/0 ..... N77-26168 #
AD-A038157/8 ..... N77-26114 #
AD-A038183/0 ..... N77-26113 #
AD-A038192/1 ..... N77-26148 #
AD-A038491/7 ..... N77-26115 #
AD-A038492/5 ..... N77-26116 #
AD-A038493/3 ..... N77-26117 #

ADL-C-75953 ..... N77-26294 #

AEDC-TR-76-158 ..... N77-26447 #
AEDC-TR-77-5 ..... N77-26502 #
AEDC-TR-77-23 ..... N77-26145 #

AERONOMICA-ACTA-A-166-1976 ..... N77-27055

AFAL-TR-75-214 ..... N77-26504 #
AFAL-TR-76-115 ..... N77-26822 #
AFAL-TR-76-140 ..... N77-27008 #
AFAL-TR-76-196 ..... N77-26133 #
AFAL-TR-76-201 ..... N77-26853 #
AFAL-TR-76-217 ..... N77-26958 #
AFAL-TR-76-218 ..... N77-27010 #
AFAL-TR-76-223 ..... N77-26470 #
AFAL-TR-76-246 ..... N77-27009 #

AFATL-TR-76-74 ..... N77-26238 #
AFATL-TR-76-116 ..... N77-26100 #

AFCEC-TR-76-47 ..... N77-26146 #

AFFDL-TR-76-75 ..... N77-26127 #
AFFDL-TR-76-83 ..... N77-26900 #
AFFDL-TR-76-117 ..... N77-26099 #
AFFDL-TR-76-128 ..... N77-26901 #
AFFDL-TR-76-137 ..... N77-26564 #
AFFDL-TR-76-138 ..... N77-26454 #
AFFDL-TR-76-147 ..... N77-26935 #

AFGL-AFSG-352 ..... N77-26185 #

AFGL-IP-249 ..... N77-26085 #
AFGL-IP-250 ..... N77-26098 #

AFGL-TR-76-0002 ..... N77-26745 #
AFGL-TR-76-0195 ..... N77-26085 #
AFGL-TR-76-0196 ..... N77-26098 #
AFGL-TR-76-0207 ..... N77-26185 #
AFGL-TR-76-0230 ..... N77-26731 #
AFGL-TR-76-0276 ..... N77-26216 #
AFGL-TR-76-0278 ..... N77-26749 #
AFGL-TR-77-0057 ..... N77-27062 #

AFGWC-TM-76-2 ..... N77-26760 #

AFHRL-TR-76-66 ..... N77-26821 #
AFHRL-TR-76-71 ..... N77-26132 #

AFLRL-83 ..... N77-26330 #

AFML-TR-76-65 ..... N77-26072 #
AFML-TR-76-156 ..... N77-26295 #
AFML-TR-76-157 ..... N77-26294 #
AFML-TR-76-163 ..... N77-26957 #
AFML-TR-76-169 ..... N77-26300 #
AFML-TR-76-175 ..... N77-27005 #
AFML-TR-76-185 ..... N77-26559 #
AFML-TR-76-194 ..... N77-26301 #

AFOSR-TR-77-0098 ..... N77-26104 #
AFOSR-TR-77-0124 ..... N77-26878 #
AFOSR-TR-77-0209 ..... N77-26563 #

AFOSR-76-1107TR ..... N77-26449 #
AFOSR-77-0022TR ..... N77-26899 #
AFOSR-77-0032TR ..... N77-26450 #
AFOSR-77-0046TR ..... N77-26849 #
AFOSR-77-0052TR ..... N77-26833 #
AFOSR-77-0057TR ..... N77-26316 #
AFOSR-77-0061TR ..... N77-26927 #
AFOSR-77-0122TR ..... N77-26894 #
AFOSR-77-0125TR ..... N77-26891 #
AFOSR-77-0126TR ..... N77-26914 #
AFOSR-77-0132TR ..... N77-26375 #
AFOSR-77-0156TR ..... N77-26740 #
AFOSR-77-0160TR ..... N77-26453 #
AFOSR-77-0161TR ..... N77-26413 #
AFOSR-77-0162TR ..... N77-26105 #
AFOSR-77-0165TR ..... N77-26851 #
AFOSR-77-0166TR ..... N77-26888 #
AFOSR-77-0171TR ..... N77-26890 #
AFOSR-77-0173TR ..... N77-26887 #
AFOSR-77-0174TR ..... N77-26187 #
AFOSR-77-0184TR ..... N77-26852 #
AFOSR-77-0186TR ..... N77-26151 #
AFOSR-77-0189TR ..... N77-26889 #

AFOSR-77-0190TR ..... N77-26882 #
AFOSR-77-0192TR ..... N77-26562 #
AFOSR-77-0210TR ..... N77-26194 #
AFOSR-77-0216TR ..... N77-26880 #
AFOSR-77-0254TR ..... N77-26527 #
AFOSR-77-0257TR ..... N77-26751 #
AFOSR-77-0259TR ..... N77-26892 #
AFOSR-77-0283TR ..... N77-26913 #
AFOSR-77-0284TR ..... N77-26902 #
AFOSR-77-0314TR ..... N77-26334 #
AFOSR-77-0315TR ..... N77-26801 #
AFOSR-77-0322TR ..... N77-26244 #
AFOSR-77-0328TR ..... N77-26472 #
AFOSR-77-0377TR ..... N77-26802 #
AFOSR-77-1091TR ..... N77-26299 #

AFRPL-TR-76-62 ..... N77-26200 #
AFRPL-TR-76-66-VOL-1 ..... N77-26491 #
AFRPL-TR-76-66-VOL-2 ..... N77-26492 #
AFRPL-TR-76-76 ..... N77-26331 #
AFRPL-TR-76-87 ..... N77-26192 #
AFRPL-TR-76-99-VOL-1 ..... N77-26234 #
AFRPL-TR-76-99-VOL-2 ..... N77-26235 #
AFRPL-TR-76-101 ..... N77-26237 #
AFRPL-TR-77-2 ..... N77-26236 #

AFWL-TR-76-98 ..... N77-26416 #
AFWL-TR-76-180 ..... N77-26475 #
AFWL-TR-76-192-VOL-1 ..... N77-26561 #
AFWL-TR-76-249 ..... N77-26374 #

AGARD-LS-89 ..... N77-26161 #

AI-ERDA-13176 ..... N77-26655 #
AI-ERDA-13178 ..... N77-26654 #

AI-M-380 ..... N77-26411 #
AI-M-383 ..... N77-26848 #
AI-M-383A ..... N77-26876 #
AI-M-387 ..... N77-26847 #

AIRESEARCH-75-311274B ..... N77-26644 #
AIRESEARCH-76-411479 ..... N77-26451 #
AIRESEARCH-76-411516 ..... N77-26141 #

AMMRC-CTR-76-39 ..... N77-26273 #

AMMRC-MS-77-2 ..... N77-26319 #

AMRL-HESS-77-2 ..... N77-26808 #

AMRL-TR-76-38 ..... N77-26384 #
AMRL-TR-76-87 ..... N77-26812 #
AMRL-TR-77-6 ..... N77-26808 #

ANCR-1302 ..... N77-26516 #

ANL-CT-76-50 ..... N77-26540 #

ANL-ENG-76-04 ..... N77-26988 #

ANL-76-XX-14 ..... N77-26708 #
ANL-76-XX-22 ..... N77-26707 #
ANL-76-48 ..... N77-26544 #

APL/JHU-TG-1305 ..... N77-26196 #

AR-5 ..... N77-26585*#
AR-000-291 ..... N77-26881
AR-282 ..... N77-26247

ARO-ETF-TR-76-101 ..... N77-26145 #
ARO-ETF-TR-76-107 ..... N77-26502 #
ARO-ETF-TR-76-121 ..... N77-26447 #

ARO-77-1 ..... N77-26886 #
ARO-10259.11-C ..... N77-26317 #
ARO-10878.2-EN ..... N77-26744 #
ARO-11101.4-EL ..... N77-26390 #
ARO-11991.1-EL ..... N77-26377 #
ARO-13603.1-R-P ..... N77-26954 #

ASC-R-110 ..... N77-26119 #

ASD-TR-75-42 ..... N77-26469 #
ASD-TR-77-3 ..... N77-26171 #

ASRL-TR-170-5 ..... N77-26563 #

ATC-72 ..... N77-26114 #

B-12 ..... N77-26506 #

BAAR-9006-085-1-VOL-1 ..... N77-26234 #
BAAR-9006-085-1-VOL-2 ..... N77-26235 #

BBN-2950 ..... N77-26186 #
BBN-3438-VOL-1 ..... N77-26359 #
BBN-3438-VOL-2 ..... N77-26360 #
BBN-3438-VOL-3 ..... N77-26361 #
BBN-3438-VOL-4 ..... N77-26362 #
BBN-3438-VOL-5 ..... N77-26363 #

BDX-613-1368 ..... N77-26514 #

BLL-CE-TRANS-6837-(9022.09) N77-26915
BLL-CE-TRANS-7067-(9022.09) N77-26417

BLL-CTO-1262-(9091.9F) N77-26975
BLL-CTO-1267-(9091.9F) N77-26974
BLL-CTO-1282-(9091.9F) N77-26971
BLL-CTO-1283-(9091.9F) N77-26973
BLL-CTO-1284-(9091.9F) N77-26972
BLL-CTO-1286-(9091.9F) N77-26963
BLL-CTO-1287-(9091.9F) N77-26964
BLL-CTO-1289-(9091.9F) N77-26966
BLL-CTO-1290-(9091.9F) N77-26968
BLL-CTO-1291-(9091.9F) N77-26962
BLL-CTO-1292-(9091.9F) N77-26965
BLL-CTO-1296-(9091.9F) N77-26969
BLL-CTO-1300-(9091.9F) N77-26970

BLL-M-24884-(5828.4F) N77-26246
BLL-M-25504-(5828.4F) N77-26268

BLL-PO-TRANS-3407-(9022.81) N77-26343

BLL-PO-3384-(9022.81) N77-26345
BLL-PO-3394-(9022.81) N77-26346

BLL-RISLEY-TR-1285-(9091.9F) N77-26967

BLL-RTS-9748 ..... N77-26511
BLL-RTS-9956 ..... N77-26419
BLL-RTS-9959 ..... N77-26418
BLL-RTS-10018 ..... N77-26925
BLL-RTS-10323 ..... N77-26903
BLL-RTS-10357 ..... N77-26420
BLL-RTS-10421 ..... N77-26455
BLL-RTS-10426 ..... N77-26531
BLL-RTS-10440 ..... N77-26530
BLL-RTS-10578 ..... N77-26342

BLL-TRANS-3433-(9022.81) N77-26344

BLM/SE-77-02 ..... N77-26677 #
BLM/SE-77-02-PT-2 ..... N77-26693 #

BM-RI-8207 ..... N77-26290 #
BM-RI-8208 ..... N77-26292 #

BMFT-FB-T-76-51 ..... N77-26402 #

BMFT-FB-W-76-23 ..... N77-26597 #
BMFT-FB-W-76-24 ..... N77-26358 #
BMFT-FB-W-76-25 ..... N77-26201 #
BMFT-FB-W-76-26-VOL-1 ..... N77-26436 #
BMFT-FB-W-76-27-VOL-2 ..... N77-26437 #

BMI-NUREG-1961 ..... N77-26283 #

BNL-NUREG-50574 ..... N77-26282 #

BNL-20425 ..... N77-26817 #
BNL-21591 ..... N77-26661 #
BNL-21698 ..... N77-26713 #
BNL-21714 ..... N77-26863 #
BNL-21723 ..... N77-26666 #
BNL-21809 ..... N77-26595 #
BNL-21837 ..... N77-27058 #
BNL-21946 ..... N77-26736 #
BNL-21964 ..... N77-26997 #
BNL-21977 ..... N77-26254 #
BNL-50580 ..... N77-26650 #

BNWL-SA-5645 ..... N77-26704 #
BNWL-SA-5755 ..... N77-26249 #

BNWL-SA-5880 ..... N77-26766 #
BNWL-SA-5931 ..... N77-26706 #
BNWL-SA-5936 ..... N77-26991 #

BNWL-2113 ..... N77-26737 #
BNWL-2154 ..... N77-26665 #

BRL-CR-327 ..... N77-26520 #
BRL-CR-332 ..... N77-26738 #

BRL-IMR-267 ..... N77-26738 #
BRL-IMR-361 ..... N77-26738 #

BRL-MR-2728 ..... N77-26097 #

BRL-1955 ..... N77-26521 #
BRL-1962 ..... N77-26539 #
BRL-1963 ..... N77-26262 #
BRL-1966 ..... N77-26429 #

CAES-PUB-445-76 ..... N77-26801 #

CALT-767P4-49 ..... N77-26929 #

CERL-TR-M-203 ..... N77-26302 #

CFT-RR-76-32 ..... N77-26272*#

CL-1975-27 ..... N77-26793 #

CN-ISSN-0082-5255 ..... N77-26421 #
CN-ISSN-0082-5255 ..... N77-26426 #

CONF-740779 ..... N77-26817 #
CONF-750942-2 ..... N77-26660 #
CONF-751130-44 ..... N77-26938 #
CONF-760363 ..... N77-26787 #
CONF-760686-1 ..... N77-26995 #
CONF-760706-6 ..... N77-26285 #
CONF-760742-1 ..... N77-26766 #
CONF-760819-16 ..... N77-26284 #
CONF-760842-15 ..... N77-27057 #
CONF-760842-18 ..... N77-26657 #
CONF-760849-1 ..... N77-26939 #
CONF-760852-1 ..... N77-26704 #
CONF-760858-2 ..... N77-26275 #
CONF-760860-1 ..... N77-26994 #
CONF-760872-1 ..... N77-26734 #
CONF-760873 ..... N77-26869 #
CONF-760934-6 ..... N77-26866 #
CONF-760935-36 ..... N77-26978 #
CONF-760935-48 ..... N77-26984 #
CONF-760946-5 ..... N77-26799 #
CONF-760948-2 ..... N77-26993 #
CONF-760949-5 ..... N77-26484 #
CONF-760958-7 ..... N77-26982 #
CONF-760959-1 ..... N77-26249 #
CONF-760961-8 ..... N77-26468 #
CONF-760972-1 ..... N77-26865 #
CONF-760973-1 ..... N77-27058 #
CONF-760984-1 ..... N77-26313 #
CONF-760985-1 ..... N77-26736 #
CONF-761006-31 ..... N77-26394 #
CONF-761012-29 ..... N77-26979 #
CONF-761016-6 ..... N77-26325 #
CONF-761027-7 ..... N77-27000 #
CONF-761030-1 ..... N77-26651 #
CONF-761031-5 ..... N77-26798 #
CONF-761038-1 ..... N77-26649 #
CONF-761044-1 ..... N77-26666 #
CONF-761046-1 ..... N77-26658 #
CONF-761059-6 ..... N77-26932 #
CONF-761059-17 ..... N77-26933 #
CONF-761060-1 ..... N77-26461 #
CONF-761062 ..... N77-26543 #
CONF-761062-1 ..... N77-26813 #
CONF-761062-2 ..... N77-26189 #
CONF-761062-4 ..... N77-26396 #
CONF-761064-5 ..... N77-26672 #
CONF-761103-16 ..... N77-26816 #
CONF-761105-1 ..... N77-26466 #
CONF-761105-3 ..... N77-27022 #
CONF-761105-4 ..... N77-26465 #
CONF-761106 ..... N77-26392 #
CONF-761106-8 ..... N77-26464 #
CONF-761106-12 ..... N77-26487 #
CONF-761107-1 ..... N77-26279 #
CONF-761107-5 ..... N77-26435 #
CONF-761107-6 ..... N77-26546 #
CONF-761107-7 ..... N77-26431 #
CONF-761107-9 ..... N77-26661 #
CONF-761107-13 ..... N77-26659 #
CONF-761107-14 ..... N77-26542 #
CONF-761107-17 ..... N77-26668 #
CONF-761107-19 ..... N77-26815 #
CONF-761108-8 ..... N77-26983 #
CONF-761109-5 ..... N77-26713 #
CONF-761113-1 ..... N77-26840 #
CONF-761117-1 ..... N77-26398 #
CONF-761120 ..... N77-26408 #
CONF-761122-1 ..... N77-26595 #
CONF-761127-4 ..... N77-26280 #
CONF-761129 ..... N77-26653 #
CONF-761130-1 ..... N77-26647 #
CONF-761130-2 ..... N77-26671 #
CONF-761130-3 ..... N77-26652 #
CONF-761137-1 ..... N77-26255 #
CONF-761137-2 ..... N77-26254 #
CONF-761142-1 ..... N77-26250 #
CONF-761143-1 ..... N77-26669 #
CONF-761147 ..... N77-26515 #
CONF-761202-2 ..... N77-26706 #
CONF-770304-4 ..... N77-26940 #

CONS/2551-1 ..... N77-26998 #

CONTRIB-5290 ..... N77-26929 #

COO-1340-52 ..... N77-26646 #
COO-1591-31 ..... N77-26996 #
COO-2059-55 ..... N77-26980*#
COO-2086-87 ..... N77-26930 #
COO-2172-14 ..... N77-26275 #
COO-2421-03 ..... N77-26277 #
COO-2422-08 ..... N77-26541 #
COO-2487-4 ..... N77-26864 #
COO-2523-8 ..... N77-26483 #
COO-2557-1 ..... N77-26931 #
COO-2683-76-11 ..... N77-26674 #
COO-2721-76-1 ..... N77-26670 #
COO-2868-1 ..... N77-26676 #
COO-2874-3 ..... N77-26705 #
COO-2874-4 ..... N77-26709 #
COO-2874-11 ..... N77-26710 #
COO-2900-6 ..... N77-26656 #
COO-2920-2 ..... N77-26486 #
COO-2923-001 ..... N77-26314 #
COO-2934-76-1 ..... N77-26673 #
COO-2982-7 ..... N77-26325 #
COO-4062-2 ..... N77-26432 #

CRIF-PL-10 ..... N77-26315 #

CRREL-TL-597 ..... N77-26428 #
CRREL-TL-599 ..... N77-26427 #

CW-WR-76-028.2 ..... N77-26134*#

C75-370/501 ..... N77-27011 #

DAAG-AMZ-1 ..... N77-27029 #

DARCOM-P-706-358 ..... N77-26519 #

DECC-61131-002 ..... N77-26407 #

DGS-249 ..... N77-26749 #

DLR-FB-76-36 ..... N77-26091 #
DLR-FB-76-57 ..... N77-26445 #
DLR-FB-76-59 ..... N77-26170 #
DLR-FB-76-61 ..... N77-26288 #
DLR-FB-76-63 ..... N77-26157 #
DLR-FB-76-65 ..... N77-26092 #

DMS-DR-2342 ..... N77-26197*#

DN-1.4-7-54 ..... N77-26174*#
DN-1.4-7-57 ..... N77-26199*#
DN-1.4-8-020 ..... N77-26175*#

DNA-4066F ..... N77-26459 #

DOC-76SDS4248 ..... N77-26594*#
DOC-76SDS4278 ..... N77-26593*#
DOC-77SDB016 ..... N77-26424 #

DP-MS-75-127 ..... N77-26431 #

DR-923 ..... N77-26761 #
DR-925 ..... N77-26782 #
DR-927 ..... N77-26777 #
DR-929 ..... N77-26763 #
DR-930 ..... N77-26764 #
DR-931 ..... N77-26781 #
DR-932 ..... N77-26780 #
DR-933 ..... N77-26779 #
DR-934 ..... N77-26762 #
DR-935 ..... N77-26778 #

DRDMI-H-77-1 ..... N77-26510 #

DRDMI-TD-77-2 ..... N77-26093 #

DREP-TM-76-12 ..... N77-26474 #

DRIC-BR-54506 ..... N77-26805 #

DW-77-1 ..... N77-26071 #

D6-44121-3 ..... N77-26140*#
D210-11175-1 ..... N77-26139*#

E-9032 ..... N77-26270*#
E-9040 ..... N77-26701*#
E-9084 ..... N77-27035*#
E-9107 ..... N77-26829*#
E-9113 ..... N77-26136*#
E-9114 ..... N77-26137*#
E-9148 ..... N77-26222*#
E-9173 ..... N77-26678*#
E-9178 ..... N77-26269*#
E-9190 ..... N77-26153*#
E-9193 ..... N77-26612*#
E-9194 ..... N77-26613*#
E-9196 ..... N77-26616*#
E-9197 ..... N77-26614*#
E-9200 ..... N77-26615*#

ECOM-73-0137-F ..... N77-26415 #
ECOM-4456 ..... N77-26498 #
ECOM-4459 ..... N77-26405 #
ECOM-4461 ..... N77-26180 #
ECOM-5802 ..... N77-26489 #
ECOM-5806 ..... N77-26950 #
ECOM-5809 ..... N77-26765 #
ECOM-5812 ..... N77-26503 #
ECOM-5814 ..... N77-26776 #

ED-CR-76040 ..... N77-26310 #

EE-76-7 ..... N77-26878 #

EGG-1183-2326-REV ..... N77-26463 #

EIN/CCG/76/008 ..... N77-26859 #

EM-4883 ..... N77-26149 #

EP-7356 ..... N77-26822 #

EPA-450/3-76-024 ..... N77-26715 #
EPA-450/3-76-025 ..... N77-26716 #
EPA-450/3-77-003A ..... N77-26720 #
EPA-550/9-77-401 ..... N77-26924 #
EPA-600/2-76-059 ..... N77-26719 #
EPA-600/2-76-283 ..... N77-26714 #
EPA-600/2-77-042 ..... N77-26721 #
EPA-600/3-76-109 ..... N77-26784 #
EPA-600/3-77-001A-VOL-1 ..... N77-26717 #
EPA-600/3-77-001B-VOL-2 ..... N77-26718 #
EPA-600/7-76-034B-VOL-2 ..... N77-26679 #
EPA-600/7-76-034C-VOL-3 ..... N77-26680 #
EPA-600/7-76-034D-VOL-4 ..... N77-26681 #
EPA-600/7-76-034E-VOL-5 ..... N77-26682 #
EPA-600/7-76-034F-VOL-6 ..... N77-26683 #
EPA-600/7-76-034G-VOL-7 ..... N77-26684 #
EPA-600/7-76-034H-VOL-8 ..... N77-26685 #
EPA-600/7-76-034I-VOL-9 ..... N77-26686 #
EPA-600/7-76-034J-VOL-10 ..... N77-26687 #
EPA-600/7-76-034K-VOL-11 ..... N77-26688 #
EPA-600/7-76-034L-VOL-12 ..... N77-26689 #
EPA-600/7-76-034M-VOL-13 ..... N77-26690 #
EPA-600/7-76-034N-VOL-14 ..... N77-26691 #
EPA-600/7-76-034O-VOL-15 ..... N77-26692 #

ERC-0123-3 ..... N77-26640 #
ERC-7396-4 ..... N77-26641 #

ERDA-TR-225 ..... N77-26916 #

ERDA-76-160 ..... N77-26999 #

ERDA/NASA-1002/77/10 ..... N77-26612*#
ERDA/NASA-1004/77/1 ..... N77-26613*#
ERDA/NASA-1011/77/3 ..... N77-26614*#
ERDA/NASA-1022/76/1 ..... N77-26618*#
ERDA/NASA-1022/76/2 ..... N77-26619*#
ERDA/NASA-1022/76/3 ..... N77-26620*#
ERDA/NASA-1022/76/4 ..... N77-26621*#
ERDA/NASA-1022/76/5 ..... N77-26622*#
ERDA/NASA-1022/76/6 ..... N77-26623*#
ERDA/NASA-1022/76/7 ..... N77-26624*#
ERDA/NASA-1022/76/8 ..... N77-26625*#
ERDA/NASA-1022/76/9 ..... N77-26626*#
ERDA/NASA-1022/77/13 ..... N77-26678*#
ERDA/NASA-1022/77/14 ..... N77-26615*#
ERDA/NSF-07378-75/1 ..... N77-26663 #

ERIM-193400-14-T ..... N77-26588*#
ERIM-193400-16-F ..... N77-26578*#

ES-4/76 ..... N77-26805 #

ESA-CR(P)-922-VOL-1 ..... N77-26219 #
ESA-CR(P)-922-VOL-2 ..... N77-26220 #
ESA-CR(P)-923-VOL-1 ..... N77-26945 #
ESA-CR(P)-923-VOL-2 ..... N77-26946 #

ESA-SP-119 ..... N77-26223 #
ESA-SP-123 ..... N77-26904 #

ESA-TM-171 ..... N77-26399 #
ESA-TM-174-VOL-1 ..... N77-26841 #
ESA-TM-174-VOL-2 ..... N77-26842 #

ESA-TT-366 ..... N77-26445 #
ESA-TT-367 ..... N77-26170 #
ESA-TT-373 ..... N77-26091 #
ESA-TT-380 ..... N77-26092 #
ESA-TT-389 ..... N77-26402 #

ESD-TR-76-292 ..... N77-26775 #
ESD-TR-76-360 ..... N77-26823 #
ESD-TR-76-363 ..... N77-26195 #

ESL-R-718 ..... N77-26913 #

ESL-4232-2 ..... N77-26500 #

ETS-8 ..... N77-26188 #

E77-10154 ..... N77-26569*#
E77-10155 ..... N77-26570*#
E77-10156 ..... N77-26571*#
E77-10170 ..... N77-26572*#
E77-10171 ..... N77-26573*#
E77-10172 ..... N77-26574*#
E77-10173 ..... N77-26575*#
E77-10174 ..... N77-26576*#

FA-TR-76030 ..... N77-26538 #
FA-TR-76066-PT-1 ..... N77-26297 #

FA-TT-76035 ..... N77-26293 #

FAA-AEQ-77-4 ..... N77-26148 #

FAA-AVP-77-1 ..... N77-26119 #
FAA-AVP-77-8 ..... N77-26109 #

FAA-RD-73-198-VOL-4 ..... N77-26168 #
FAA-RD-76-167 ..... N77-26113 #
FAA-RD-76-219 ..... N77-26114 #
FAA-RD-77-12-VOL-1 ..... N77-26115 #
FAA-RD-77-12-VOL-2 ..... N77-26116 #
FAA-RD-77-12-VOL-3 ..... N77-26117 #

FCR-0237 ..... N77-26637*#

FHWA-RD-M-0341 ..... N77-26558 #

FHWA-RD-76-125-VOL-1 ..... N77-27040 #
FHWA-RD-76-126-VOL-2 ..... N77-27041 #

FHWA-RD-76-127-VOL-3 ..... N77-27042 #
FHWA-RD-76-166 ..... N77-26560 #

FHWA-TX-75-218 ..... N77-26724 #

FLOW-RES-71 ..... N77-26449 #

FOK-RV-76-56 ..... N77-26548 #

FPB-E-024-VOL-1 ..... N77-26115 #
FPB-E-024-VOL-2 ..... N77-26116 #
FPB-E-024-VOL-3 ..... N77-26117 #

FR-1 ..... N77-26321 #

FSU-STATISTICS-M399 ..... N77-26527 #

G-7702-F11 ..... N77-26457*#
G-7702-F12 ..... N77-27046*#

GA-A-13992 ..... N77-26981 #

GCA-TR-76-25-G(1) ..... N77-26715 #
GCA-TR-76-25-G(2) ..... N77-26716 #

GE/EE/76-29 ..... N77-26496 #
GE/EE/76D-25 ..... N77-26948 #

GED-2213 ..... N77-26366 #

GPO-76-492 ..... N77-26107 #
GPO-77-918 ..... N77-26138 #

HDL-CR-76-092-1 ..... N77-26451 #

HDL-TM-77-2 ..... N77-26826 #

HEDL-TME-76-62 ..... N77-26281 #

HEL-TM-6-77 ..... N77-26118 #

HH-76-191-VOL-1 ..... N77-26123 #

HIG-76-3 ..... N77-26751 #

HUD-PDR-156(2) ..... N77-26639 #

IAEA-CN-35/A-12 ..... N77-26971
IAEA-CN-35/B-4 ..... N77-26972
IAEA-CN-35/E-21 ..... N77-26962

IFKKI-76/11 ..... N77-27062 #

IIEQ-76-26 ..... N77-26723 #

IITRI-L6337-FR ..... N77-26528 #

IITRI-J6339 ..... N77-26260 #

IR-3 ..... N77-26640 #
IR-3 ..... N77-26794*#
IR-5 ..... N77-26273 #
IR-217 ..... N77-26844 #

IRI-132-76-03 ..... N77-26401 #

IRT-6102-003 ..... N77-26526 #

IS-M-72 ..... N77-26285 #

ISBN-3-88148-149-4 ..... N77-26752
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ISI/RR-77-54 ..... N77-26874 #

ISL-CC-219/76 ..... N77-26328 #

ISL-R-104/76 ..... N77-26917 #
ISL-R-109/76 ..... N77-26329 #
ISL-R-116/76 ..... N77-26490 #
ISL-R-126/75 ..... N77-26327 #

ITR-4 ..... N77-26641 #

IZF-1976-4 ..... N77-26921 #

JSC-10607-SUPPL-1 ..... N77-26729*#
JSC-10975 ..... N77-26590*#
JSC-11685 ..... N77-26589*#
JSC-12628 ..... N77-26804*#

L-10807 ..... N77-26081*#
L-11007 ..... N77-26480*#
L-11086 ..... N77-26069*#
L-11115 ..... N77-26154*#
L-11149 ..... N77-26070*#
L-11334 ..... N77-27054*#
L-11370 ..... N77-26083*#

LA-UR-76-1413 ..... N77-26279 #
LA-UR-76-1708 ..... N77-26734 #
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LA-UR-76-2097 ..... N77-26798 #
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LA-UR-76-2294 ..... N77-26649 #
LA-UR-76-2321 ..... N77-26865 #
LA-UR-76-2387 ..... N77-26392 #
LA-UR-76-2502 ..... N77-26866 #
LA-UR-76-2529 ..... N77-26799 #
LA-UR-77-59 ..... N77-26940 #

LA-6539-PR ..... N77-26703 #

LBL-5292 ..... N77-26657 #
LBL-5387 ..... N77-26658 #
LBL-5456 ..... N77-26993 #
LBL-5464 ..... N77-26994 #
LBL-5493 ..... N77-26992 #
LBL-5500 ..... N77-26939 #
LBL-5504 ..... N77-27022 #
LBL-5505 ..... N77-26465 #
LBL-5506 ..... N77-26466 #
LBL-5567 ..... N77-26394 #

LC-76-608406 ..... N77-26924 #

LEC-7790-REV-A ..... N77-26590*#
LEC-10595 ..... N77-26804*#

LLL-02222 ..... N77-26395 #

LMSC-D508255 ..... N77-26794*#

LMSC-HREC-TR-D497000 ..... N77-26497 #

LOGO-M-30 ..... N77-26848 #
LOGO-M-30A ..... N77-26876 #
LOGO-M-34 ..... N77-26847 #

LS76-1-VOL-1 ..... N77-27033 #
LS76-1-VOL-2 ..... N77-27028 #

M-2B-TAGSEA-023 ..... N77-26883 #

MBB-UFE-1168(0) ..... N77-26124 #
MBB-UFE-1182(0) ..... N77-26155 #
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MBB-UFE-1191(0) ..... N77-26156 #

MBL-1976-4 ..... N77-26789 #
MBL-1976-6 ..... N77-26790 #
MBL-1976-7 ..... N77-26791 #
MBL-1976-10 ..... N77-26934 #
MBL-1976-11 ..... N77-26792 #
MBL-1976-12 ..... N77-26326 #

MDC-G6553 ..... N77-26849 #

MDC-J6952 ..... N77-26127 #

ME-AMC-0467 ..... N77-26243 #

MIT-2793-5 ..... N77-26251 #

MRC-DA-578 ..... N77-26721 #

MRL-R-680 ..... N77-26881

MRL-TM-387 ..... N77-26937

MRL-TN-388 ..... N77-26247

MRR-77-1 ..... N77-26914 #

MSNW-77-1049-1 ..... N77-26481 #

MSNW/AC-76-2074 ..... N77-26693 #
MSNW/HRPI-76-274 ..... N77-26677 #

MSR-76-43 ..... N77-26810 #

MTR-3161 ..... N77-26195 #
MTR-3300 ..... N77-26775 #
MTR-3312 ..... N77-26823 #
MTR-7439-VOL-1 ..... N77-26367 #
MTR-7439-VOL-2 ..... N77-26368 #

N-30-472-0 ..... N77-26190 #
N-30-486-0 ..... N77-26191 #

NA-76-865 ..... N77-26076*#

NADC-75208-30 ..... N77-26150 #
NADC-76180-30-VOL-1 ..... N77-26143 #
NADC-76180-30-VOL-2 ..... N77-26144 #
NADC-76235-30 ..... N77-26126 #
NADC-76312-30-VOL-1 ..... N77-26158 #
NADC-76313-30-VOL-2 ..... N77-26159 #
NADC-76322-30 ..... N77-26096 #
NADC-76380-30 ..... N77-26513 #

NAFI-TR-2148-REV-1 ..... N77-26471 #

NAPTC-PE-99 ..... N77-26333 #

NARADCOM-TR-76-60-AMEL ..... N77-26102 #

NASA-CASE-ARC-11057-1 ..... N77-26308*#

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NASA-CASE-MFO-13673-1 ..... N77-26919*

NASA-CP-2010 ..... N77-26618*#
NASA-CP-2010 ..... N77-26619*#
NASA-CR-2010 ..... N77-26620*#
NASA-CP-2010 ..... N77-26621*#
NASA-CP-2010 ..... N77-26622*#
NASA-CP-2010 ..... N77-26623*#
NASA-CP-2010 ..... N77-26624*#
NASA-CP-2010 ..... N77-26625*#
NASA-CP-2010 ..... N77-26626*#

NASA-CR-2841 ..... N77-26140*#
NASA-CR-134942-VOL-1 ..... N77-26628*#
NASA-CR-134942-VOL-2 ..... N77-26629*#
NASA-CR-134942-VOL-3 ..... N77-26630*#
NASA-CR-134949-VOL-1 ..... N77-26631*#
NASA-CR-134949-VOL-2-PT-1 ..... N77-26632*#
NASA-CR-134949-VOL-2-PT-2 ..... N77-26633*#
NASA-CR-134949-VOL-2-PT-3 ..... N77-26634*#
NASA-CR-134949-VOL-2-PT-4 ..... N77-26635*#
NASA-CR-134949-VOL-3 ..... N77-26636*#
NASA-CR-134955 ..... N77-26637*#
NASA-CR-135119 ..... N77-26134*#
NASA-CR-135184 ..... N77-26135*#
NASA-CR-135221 ..... N77-26221*
NASA-CR-135222 ..... N77-26577*#
NASA-CR-141422 ..... N77-26730*#
NASA-CR-143841 ..... N77-26076*#
NASA-CR-145117 ..... N77-26121*#
NASA-CR-145198 ..... N77-26241*#
NASA-CR-145199 ..... N77-26732*#
NASA-CR-145200 ..... N77-26897*#
NASA-CR-145202 ..... N77-26075*#
NASA-CR-149155 ..... N77-26728*#
NASA-CR-149891 ..... N77-27048*#
NASA-CR-149997 ..... N77-26184*#
NASA-CR-150299 ..... N77-26828*#
NASA-CR-150300 ..... N77-26610*#
NASA-CR-150303 ..... N77-26181*#
NASA-CR-150305 ..... N77-26611*#
NASA-CR-150306 ..... N77-26581*#
NASA-CR-150311 ..... N77-26176*#
NASA-CR-150312 ..... N77-26753*#
NASA-CR-150313 ..... N77-26272*#
NASA-CR-151074 ..... N77-26197*#
NASA-CR-151351 ..... N77-26592*#
NASA-CR-151419 ..... N77-26532*#
NASA-CR-151426 ..... N77-26579*#
NASA-CR-151427 ..... N77-26456*#
NASA-CR-151431 ..... N77-26580*#
NASA-CR-151432 ..... N77-26794*#
NASA-CR-151434 ..... N77-26174*#
NASA-CR-151435 ..... N77-26175*#
NASA-CR-151436 ..... N77-26199*#
NASA-CR-151438 ..... N77-26804*#
NASA-CR-151439 ..... N77-26348*#
NASA-CR-151440 ..... N77-26943*#
NASA-CR-151441 ..... N77-26590*#
NASA-CR-151954 ..... N77-26139*#
NASA-CR-151967 ..... N77-26423*#
NASA-CR-151970 ..... N77-26106*#
NASA-CR-152005 ..... N77-26108*#
NASA-CR-152022 ..... N77-26077*#
NASA-CR-152023 ..... N77-26078*#
NASA-CR-152024 ..... N77-26079*#
NASA-CR-152474 ..... N77-26593*#
NASA-CR-152475 ..... N77-26594*#
NASA-CR-152508 ..... N77-26177*#
NASA-CR-152525 ..... N77-26458*#
NASA-CR-152535 ..... N77-26347*#
NASA-CR-152707 ..... N77-26569*#
NASA-CR-152709 ..... N77-26570*#
NASA-CR-152710 ..... N77-26571*#
NASA-CR-152862 ..... N77-26980*#
NASA-CR-152863 ..... N77-26739*#
NASA-CR-152866 ..... N77-27007*#
NASA-CR-153211 ..... N77-26575*#
NASA-CR-153227 ..... N77-26573*#
NASA-CR-153228 ..... N77-26574*#
NASA-CR-153229 ..... N77-26572*#
NASA-CR-153262 ..... N77-26576*#
NASA-CR-153263 ..... N77-26534*#
NASA-CR-153264 ..... N77-26727*#
NASA-CR-153265 ..... N77-26112*#
NASA-CR-153265 ..... N77-27052*#
NASA-CR-153267 ..... N77-27051*#
NASA-CR-153271 ..... N77-26478*#
NASA-CR-153272 ..... N77-27034*#
NASA-CR-153278 ..... N77-26795*#
NASA-CR-153279 ..... N77-26586*#
NASA-CR-153280 ..... N77-26587*#
NASA-CR-153282 ..... N77-26588*#
NASA-CR-153283 ..... N77-26582*#
NASA-CR-153284 ..... N77-26583*#
NASA-CR-153286 ..... N77-26584*#
NASA-CR-153287 ..... N77-26585*#
NASA-CR-153288 ..... N77-26568*
NASA-CR-153289 ..... N77-26627*#
NASA-CR-153291 ..... N77-26122*#
NASA-CR-153292 ..... N77-26479*#
NASA-CR-153392 ..... N77-26578*#
NASA-CR-153393 ..... N77-27047*#
NASA-CR-154618 ..... N77-27020*#
NASA-CR-154619 ..... N77-27021*#

NASA-SP-418 ..... N77-27053*#
NASA-SP-7037(83) ..... N77-26066*#

NASA-TM-X-71307 ..... N77-26827*#
NASA-TM-X-71313 ..... N77-27050*#
NASA-TM-X-71335 ..... N77-27061*#
NASA-TM-X-71337 ..... N77-26567*#
NASA-TM-X-71339 ..... N77-26349*#
NASA-TM-X-71340 ..... N77-26248*#
NASA-TM-X-71341 ..... N77-27056*#
NASA-TM-X-71343 ..... N77-26425*#
NASA-TM-X-71344 ..... N77-26926*#
NASA-TM-X-73244 ..... N77-26067*#
NASA-TM-X-73245 ..... N77-27063*#
NASA-TM-X-73253 ..... N77-26533*#
NASA-TM-X-73394 ..... N77-26198*#
NASA-TM-X-73607 ..... N77-27035*#
NASA-TM-X-73618 ..... N77-26829*#
NASA-TM-X-73622 ..... N77-26136*#
NASA-TM-X-73623 ..... N77-26137*#
NASA-TM-X-73636 ..... N77-26183*#
NASA-TM-X-73643 ..... N77-26222*#

NASA-TM-X-73657 ..... N77-26678*#
NASA-TM-X-73661 ..... N77-26269*#
NASA-TM-X-73669 ..... N77-26612*#
NASA-TM-X-73670 ..... N77-26613*#
NASA-TM-X-73671 ..... N77-26153*#
NASA-TM-X-73672 ..... N77-26614*#
NASA-TM-X-73674 ..... N77-26615*#
NASA-TM-X-73676 ..... N77-26616*#
NASA-TM-X-73677 ..... N77-26617*#
NASA-TM-X-73682 ..... N77-26270*#
NASA-TM-X-74753 ..... N77-26271*#

NASA-TM-73163 ..... N77-26111*#
NASA-TM-73248 ..... N77-26068*#
NASA-TM-74623 ..... N77-26589*#
NASA-TM-74755 ..... N77-26729*#
NASA-TM-75020 ..... N77-26182*#

NASA-TN-D-8379 ..... N77-26920*#
NASA-TN-D-8380 ..... N77-26070*#
NASA-TN-D-8410 ..... N77-26069*#
NASA-TN-D-8418 ..... N77-26081*#
NASA-TN-D-8419 ..... N77-26154*#
NASA-TN-D-8434 ..... N77-26702*#
NASA-TN-D-8446 ..... N77-27054*#
NASA-TN-D-8447 ..... N77-26480*#
NASA-TN-D-8456 ..... N77-26082*#
NASA-TN-D-8478 ..... N77-26083*#
NASA-TN-D-8491 ..... N77-26701*#
NASA-TN-D-8502 ..... N77-26457*#
NASA-TN-D-8509 ..... N77-27046*#

NASA-TT-F-17302 ..... N77-26322*#
NASA-TT-F-17447 ..... N77-26152*#
NASA-TT-F-17450 ..... N77-26240*#
NASA-TT-F-17521 ..... N77-26726*#

NATC-TM-76-4-SA ..... N77-26173 #

NATICK/TR-77/007 ..... N77-26245 #

NAVAIR-AIR-413-6MPXYO-1 ..... N77-26172 #

NAVTRAEQUIPC-TN-56 ..... N77-26169 #

NAVTRAEQUIPC-74-C-0152-1 ..... N77-26260 #
NAVTRAEQUIPC-75-C-0099-1 ..... N77-26803 #

NBS-GCR-77-83 ..... N77-26267 #

NBS-HB-122 ..... N77-26924 #

NBS-TN-928 ..... N77-27019 #

NBSIR-75-945 ..... N77-26340 #
NBSIR-76-1186 ..... N77-27004 #
NBSIR-77-1219 ..... N77-26960 #

NCRE/N266 ..... N77-26291 #

NELC-TD-498 ..... N77-26872 #

NEPRF-TR-7-76(ERT) ..... N77-26747 #

NFAIS-76-1 ..... N77-27027 #

NISC-TRANS-3877 ..... N77-26448 #
NISC-TRANS-3886 ..... N77-26953 #
NISC-TRANS-3887 ..... N77-26944 #
NISC-TRANS-3897 ..... N77-26788 #

NIWARS-PUBL-30 ..... N77-26596 #

NLR-TR-73030-U ..... N77-26549 #

NOAA-TM-ERL-ARL-63 ..... N77-26722 #

NOAA-77021401 ..... N77-26722 #
NOAA-77021404 ..... N77-27060 #
NOAA-77021405 ..... N77-27059 #
NOAA-77030801 ..... N77-26786 #

NOO-RP-17 ..... N77-26591 #

NOR-76-110 ..... N77-26295 #

NORT-76Y133A ..... N77-26951 #
NORT-77Y016A ..... N77-26952 #

NPL-COM-84 ..... N77-26854 #

NPS-53BL77021 ..... N77-26896 #
NPS-56SK77011 ..... N77-26125 #

NRL-MR-3427 ..... N77-26505 #
NRL-MR-3444 ..... N77-26494 #
NRL-MR-3445 ..... N77-26989 #
NRL-MR-3446 ..... N77-26452 #
NRL-MR-3448 ..... N77-26309 #
NRL-MR-3450 ..... N77-26742 #

NRTC-77-8R ..... N77-26961 #

NSF/PRA-7501069-4-7 ..... N77-26698 #
NSF/PRA-7501069-5-7 ..... N77-26699 #
NSF/RA-706188 ..... N77-26663 #
NSF/RA-760370-VOL-3 ..... N77-26606 #
NSF/RA-760444 ..... N77-26987 #
NSF/RA-760445 ..... N77-26697 #
NSF/RA-770015 ..... N77-26341 #
NSF/RANN/SE/AER74-00239/PR-26 ..... N77-26664 #

NSWC/DL-TR-3624 ..... N77-26608 #

NTSB-ARC-77-1 ..... N77-26110 #

NUC-TP-506 ..... N77-26379 #
NUC-TP-509 ..... N77-26893 #
NUC-TP-530 ..... N77-26357 #

NWC-TP-5881 ..... N77-26186 #
NWC-TP-5916 ..... N77-26609 #

OHR-10 ..... N77-26599 #

ONERA-DERTS-NT-03-11 ..... N77-26388 +

ONR-CR215-213-5 ..... N77-26131 #
ONR-CR215-228-2 ..... N77-26879 #
ONR-CR215-231-3 ..... N77-26101 #

ONRL-C-1-77 ..... N77-27012 #
ONRL-C-37-76 ..... N77-27016 #
ONRL-C-39-76 ..... N77-26936 #
ONRL-C-49-76 ..... N77-26696 #

ONRL-R-1-77 ..... N77-26535 #
ONRL-R-13-76 ..... N77-26339 #

ORC-77-2 ..... N77-26850 #

ORNL-TR-4230 ..... N77-26735 #
ORNL-TR-4231 ..... N77-26712 #
ORNL-TR-4234 ..... N77-26711 #
ORNL-TR-4272 ..... N77-26287 #

ORNL-4778-REV ..... N77-26884 #
ORNL-5202 ..... N77-26545 #
ORNL-5223 ..... N77-26278 #

ORNL/CSD-18-(SUPPL-1) ..... N77-26884 #
ORNL/SUB-3720-1 ..... N77-26274 #
ORNL/TM-5658 ..... N77-26312 #
ORNL/TM-5663 ..... N77-26662 #

ORO-5017-1 ..... N77-26787 #

OSD-1366 ..... N77-26950 #

OSURF-3890 ..... N77-26935 #

OTP-77-06(C)-VOL-1 ..... N77-26367 #
OTP-77-07(C)-VOL-2 ..... N77-26368 #

OUEL-1156/76 ..... N77-26873 #
OUEL-1157/76 ..... N77-26440 #
OUEL-1159/76 ..... N77-26941 #
OUEL-1162/76 ..... N77-26090 #
OUEL-1163/76 ..... N77-26337 #
OUEL-1168/76 ..... N77-26550 #
OUEL-1175/76 ..... N77-26441 #
OUEL-1178/76 ..... N77-26843 #
OUEL-1181/77 ..... N77-26442 #

OWRT-A-036-LA(2) ..... N77-27039 #

OWRT-C-7508(10)(1 ..... N77-26601 #

P-5667 ..... N77-27030 #
P-5684 ..... N77-27032 #

PA-TR-2223 ..... N77-26257 #

PA-TR-5020 ..... N77-26336 #

PAR-76-26 ..... N77-26956 #

PB-262600/0 ..... N77-27019 #
PB-263476/4 ..... N77-26601 #
PB-263550/6 ..... N77-26558 #
PB-263665/2 ..... N77-26715 #
PB-263666/0 ..... N77-26716 #
PB-263873/2 ..... N77-26987 #
PB-263952/4 ..... N77-26785 #
PB-264058/8 ..... N77-27040 #
PB-264055/5 ..... N77-27041 #
PB-264056/3 ..... N77-27042 #
PB-264067/0 ..... N77-26721 #
PB-264201/5 ..... N77-26719 #
PB-264205/6 ..... N77-26784 #
PB-264221/3 ..... N77-26697 #
PB-264232/0 ..... N77-26717 #
PB-264233/8 ..... N77-26718 #
PB-264253/6 ..... N77-26292 #
PB-264258/5 ..... N77-26340 #
PB-264268/4 ..... N77-26679 #
PB-264269/2 ..... N77-26680 #
PB-264270/0 ..... N77-26681 #
PB-264271/8 ..... N77-26682 #
PB-264272/6 ..... N77-26683 #
PB-264273/4 ..... N77-26684 #
PB-264274/2 ..... N77-26685 #
PB-264275/9 ..... N77-26686 #
PB-264276/7 ..... N77-26687 #
PB-264277/5 ..... N77-26688 #
PB-264278/3 ..... N77-26689 #
PB-264279/1 ..... N77-26690 #
PB-264280/9 ..... N77-26691 #
PB-264281/7 ..... N77-26692 #
PB-264285/8 ..... N77-26607 #
PB-264295/7 ..... N77-26290 #
PB-264345/0 ..... N77-26714 #
PB-264346/8 ..... N77-26110 #
PB-264415/1 ..... N77-26606 #
PB-264447/4 ..... N77-26367 #
PB-264448/2 ..... N77-26368 #
PB-264458/1 ..... N77-26698 #
PB-264459/9 ..... N77-26699 #
PB-264474/8 ..... N77-26602 #
PB-264475/5 ..... N77-26603 #
PB-264476/3 ..... N77-26604 #
PB-264477/1 ..... N77-26605 #
PB-264504/2 ..... N77-27039 #
PB-264554/7 ..... N77-27044 #
PB-264559/6 ..... N77-27027 #
PB-264590/1 ..... N77-26724 #
PB-264642/0 ..... N77-26723 #
PB-264665/1 ..... N77-26560 #
PB-264667/7 ..... N77-26924 #
PB-264670/1 ..... N77-27043 #
PB-264686/7 ..... N77-26720 #
PB-264705/5 ..... N77-26677 #
PB-264706/3 ..... N77-26693 #
PB-264788/1 ..... N77-26722 #
PB-264790/7 ..... N77-27060 #
PB-264791/5 ..... N77-27059 #
PB-264866/5 ..... N77-27045 #
PB-265228/7 ..... N77-26267 #
PB-265265 ..... N77-26786 #
PB-265817/7 ..... N77-26341 #

PDO-6984517 ..... N77-26514 #

PE-13262 ..... N77-26493 #

PPPL-1287 ..... N77-26313 #
PPPL-1296 ..... N77-26978 #
PPPL-1308 ..... N77-26976 #

PR-76-2 ..... N77-26727*#

PRRL-76-CR-4 ..... N77-27009 #
PRRL-76-CR-61 ..... N77-26410 #

PSI-TR-71 ..... N77-26486 #

PSR-612 ..... N77-26365 #

PUBL-71-0989-00-00 ..... N77-26181*#
PUBL-516 ..... N77-26438 #

QPR-6 ..... N77-26414 #

QR-1 ..... N77-26951 #
QR-2 ..... N77-26952 #
QR-3-PT-3 ..... N77-26770 #
QR-3-PT-3 ..... N77-26772 #
QR-4 ..... N77-26324 #
QR-4 ..... N77-26767 #
QR-4-PT-4 ..... N77-26769 #
QR-4-PT-4 ..... N77-26771 #
QR-4-PT-4 ..... N77-26773 #
QR-16 ..... N77-26594*#

QTPR-1 ..... N77-26347*#

R-77-112 ..... N77-26259 #
R-1031 ..... N77-26732*#
R-1457 ..... N77-26523 #
R-1493 ..... N77-26148 #
R-4939 ..... N77-26192 #
R-4939 ..... N77-26237 #
R-1276007 ..... N77-26094 #

RADC-TR-76-261-VOL-1-PT-1-BK-3 ..... N77-26217 #
RADC-TR-76-267 ..... N77-26412 #
RADC-TR-76-295 ..... N77-26364 #
RADC-TR-76-305 ..... N77-27002 #
RADC-TR-76-323 ..... N77-27013 #
RADC-TR-76-327 ..... N77-26376 #
RADC-TR-76-343 ..... N77-27001 #
RADC-TR-76-344 ..... N77-27031 #
RADC-TR-76-355 ..... N77-26298 #
RADC-TR-76-356 ..... N77-27011 #
RADC-TR-76-357 ..... N77-26959 #
RADC-TR-76-359 ..... N77-26378 #
RADC-TR-76-361 ..... N77-26307 #
RADC-TR-76-369 ..... N77-26406 #
RADC-TR-76-375 ..... N77-26365 #
RADC-TR-76-378 ..... N77-26748 #
RADC-TR-76-379-PT-3 ..... N77-26356 #
RADC-TR-76-389 ..... N77-26500 #
RADC-TR-76-394 ..... N77-26372 #
RADC-TR-76-394-VOL-1/2/3 ..... N77-26370 #
RADC-TR-76-394-VOL-4 ..... N77-26373 #
RADC-TR-76-394-VOL-5 ..... N77-26373 #
RADC-TR-76-394-VOL-8 ..... N77-26371 #
RADC-TR-76-397 ..... N77-26355 #
RADC-TR-76-398 ..... N77-27006 #
RADC-TR-76-403 ..... N77-27015 #
RADC-TR-76-406 ..... N77-26383 #
RADC-TR-77-27 ..... N77-27014 #
RADC-TR-77-29 ..... N77-26380 #
RADC-TR-77-32 ..... N77-26381 #
RADC-TR-77-93 ..... N77-26382 #

RC-77-2 ..... N77-26409 #

RD-77-4 ..... N77-26086 #
RD-77-8 ..... N77-26160 #
RD-77-12 ..... N77-26084 #

REC-ERC-76-21 ..... N77-26785 #

REPT-S-89 ..... N77-26600 #

REPT-1 ..... N77-26587*#
REPT-2 ..... N77-26569*#
REPT-6-75 ..... N77-26811 #
REPT-6-76 ..... N77-26320 #
REPT-56-76-AP5 ..... N77-26300 #
REPT-75-3 ..... N77-26088 #
REPT-75-4 ..... N77-26438 #
REPT-75-12-04 ..... N77-26861 #
REPT-76-2 ..... N77-26391 #
REPT-76-2 ..... N77-26551 #
REPT-76-3 ..... N77-26553 #
REPT-76-4-VOL-1 ..... N77-26554 #
REPT-76-5-VOL-2 ..... N77-26555 #
REPT-76-9C4-SASSI-R1 ..... N77-27015 #
REPT-76-9E9-ECAS-R2-VOL-1 ..... N77-26628*#
REPT-76-9E9-ECAS-R2-VOL-2 ..... N77-26629*#
REPT-76-9E9-ECAS-R2-VOL-3 ..... N77-26630*#
REPT-76-01-03 ..... N77-26830 #

REPT-76-05-08 ..... N77-26831 #
REPT-76-06-01 ..... N77-26832 #
REPT-76-49 ..... N77-26446 #
REPT-76/66C-83 ..... N77-26120 #
REPT-77-01-06 ..... N77-26862 #
REPT-77-02-07 ..... N77-26860 #
REPT-77SR-VA-03 ..... N77-26478*#
REPT-207-S ..... N77-26547 #
REPT-318E-7616-061/ ..... N77-26469 #
REPT-891 ..... N77-26756 #
REPT-1268-1 ..... N77-26172 #
REPT-1842-EEG/EETDD-TR-77-12 ..... N77-26820 #
REPT-1842-EEG/EETET-TR-77-10 ..... N77-26825 #
REPT-4212-T-1176 ..... N77-26700 #
REPT-116400-1-F ..... N77-26733 #
REPT-770441 ..... N77-26122*#

RH-CR-76-12 ..... N77-26497 #

RIA-R-TR-76-048 ..... N77-26303 #

RPI-TA-17 ..... N77-26638 #

RR-218-1 ..... N77-26724 #

RRI-T-1/364-3-65 ..... N77-26509 #

RSC-3345 ..... N77-26579*#

RSG-312-72 ..... N77-26193 #
RSG-312-77 ..... N77-26193 #

RTR-013-1-VOL-1 ..... N77-26239 #

R76-116 ..... N77-26221*

S-74-8-VOL-4 ..... N77-26168 #
S-2156 ..... N77-26414 #

SAI-76-005-AA ..... N77-26958 #
SAI-77-001-AA ..... N77-26501 #
SAI-78-556-HU ..... N77-26828*#

SAMSO-TR-77-52 ..... N77-26743 #

SAMTEC-TR-77-32 ..... N77-26179 #

SAND-75-8743 ..... N77-26250 #
SAND-76-0111 ..... N77-26087 #
SAND-76-0146 ..... N77-26467 #
SAND-76-0311 ..... N77-26178 #
SAND-76-0343 ..... N77-26867 #
SAND-76-0373 ..... N77-26323 #
SAND-76-0389 ..... N77-26838 #
SAND-76-0432 ..... N77-26482 #
SAND-76-0532 ..... N77-26648 #
SAND-76-0589 ..... N77-26397 #
SAND-76-5311 ..... N77-26647 #
SAND-76-5459 ..... N77-26515 #
SAND-76-5472 ..... N77-26995 #
SAND-76-5668 ..... N77-26396 #
SAND-76-5886 ..... N77-26468 #
SAND-76-6038 ..... N77-26276 #
SAND-76-8048 ..... N77-26460 #
SAND-76-8511 ..... N77-26253 #
SAND-76-8710 ..... N77-26434 #
SAND-76-9019 ..... N77-26189 #
SAND-76-9142 ..... N77-26653 #
SAND-76-9188 ..... N77-26815 #

SAPR-7 ..... N77-26586*#

SASR-10 ..... N77-26568*

SATR-3 ..... N77-27013 #
SATR-5 ..... N77-26316 #
SATR-6 ..... N77-26350 #
SATR-6 ..... N77-26351 #
SATR-6 ..... N77-26352 #

SCAMS-TR-107 ..... N77-26131 #

SCIENTIFIC-2 ..... N77-26216 #
SCIENTIFIC-2 ..... N77-26244 #

SC5016.7FR ..... N77-26990 #

SDAC-TR-76-5 ..... N77-26746 #

SEL-96 ..... N77-26892 #

SER-7 ..... N77-27038 #
SER-50975 ..... N77-26129 #

SERIAL-T-343 ..... N77-26890 #

SF9 ..... N77-27007*#

SGD-389-PT-1 ..... N77-27060 #
SGD-389-PT-2 ..... N77-27059 #

SPD-615-05 ..... N77-26095 #
SPD-747-01 ..... N77-26338 #

SQUID-TRW-9-PU ..... N77-26261 #

SR-1 ..... N77-26584*#
SR-1 ..... N77-27014 #
SR-6 ..... N77-26749 #

SRD-76-064-1-VOL-1 ..... N77-26631*#
SRD-76-064-2-VOL-2-PT-1 ..... N77-26632*#
SRD-76-064-2-VOL-2-PT-2 ..... N77-26633*#
SRD-76-064-2-VOL-2-PT-3 ..... N77-26634*#
SRD-76-064-2-VOL-2-PT-4 ..... N77-26635*#
SRD-76-064-3 ..... N77-26636*#

SRI-MP-76-107 ..... N77-26488 #

SRI-TR-13 ..... N77-27023 #

SRL-6739 ..... N77-27010 #

SSI-TR-1 ..... N77-26332 #

SWRI-02-4275 ..... N77-26241*#
SWRI-15-4163 ..... N77-26299 #

TAE-328 ..... N77-26104 #

TAU-SOE/365-76 ..... N77-26244 #

TDCK-67496 ..... N77-26921 #
TDCK-67497 ..... N77-26793 #
TDCK-67752 ..... N77-26789 #
TDCK-67804 ..... N77-26791 #
TDCK-67805 ..... N77-26790 #
TDCK-68126 ..... N77-26792 #
TDCK-68321 ..... N77-26934 #
TDCK-68561 ..... N77-26326 #
TDCK-68734 ..... N77-26547 #

TE-4219-28-77 ..... N77-26645 #

TH-76-E-65 ..... N77-26400 #
TH-76-E-66 ..... N77-26439 #
TH-76-E-67 ..... N77-26986 #

TID-27143 ..... N77-26393 #
TID-27164 ..... N77-26675 #
TID-27225 ..... N77-26733 #
TID-27235 ..... N77-26928 #
TID-27251 ..... N77-26643 #
TID-27252 ..... N77-26644 #
TID-27270 ..... N77-26667 #
TID-27336 ..... N77-26324 #

TM-2-77 ..... N77-26898 #
TM-51 ..... N77-26112*#
TM-77-5 ..... N77-26610*#

TM-19 ..... N77-26607 #

TPQ-2 ..... N77-26483 #

TR-I-2 ..... N77-26618*#

TR-MC-1 ..... N77-26532*#

TR-1 ..... N77-26264 #
TR-1 ..... N77-26265 #
TR-1 ..... N77-27017 #
TR-1-7 ..... N77-26619*#
TR-2 ..... N77-26389 #
TR-2 ..... N77-26811 #
TR-2-2 ..... N77-26620*#
TR-2-4 ..... N77-26621*#

TR-2-6 ..... N77-26622*#
TR-2-7 ..... N77-26623*#
TR-2-8 ..... N77-26624*#
TR-3 ..... N77-26705 #
TR-3-1 ..... N77-26625*#
TR-3-3 ..... N77-26626*#
TR-4 ..... N77-26266 #
TR-4 ..... N77-26709 #
TR-4 ..... N77-27004 #
TR-5 ..... N77-26311 #
TR-6 ..... N77-26258 #
TR-6 ..... N77-26305 #
TR-8 ..... N77-26271*#
TR-8 ..... N77-26824 #
TR-03-75-06-5 ..... N77-26348*#
TR-11 ..... N77-26318 #
TR-12-ONR ..... N77-26499 #
TR-13 ..... N77-26750 #
TR-14 ..... N77-26750 #
TR-15 ..... N77-26750 #
TR-16 ..... N77-26750 #
TR-17 ..... N77-26750 #
TR-18 ..... N77-26750 #
TR-20 ..... N77-26537 #
TR-41 ..... N77-26274 #
TR-69 ..... N77-26527 #
TR-77-3 ..... N77-26377 #
TR-77-29 ..... N77-26188 #
TR-117 ..... N77-26811 #
TR-123 ..... N77-26320 #
TR-502 ..... N77-26891 #
TR-0077(2260-20)-6 ..... N77-26743 #

TRW-ER-7814-2 ..... N77-26304 #

TTI-2-8-75-218 ..... N77-26724 #

T76-7 ..... N77-26607 #

U-OF-IOWA-76-34 ..... N77-26739*#

UCID-17217 ..... N77-26485 #
UCID-17251 ..... N77-26834 #
UCID-17253 ..... N77-26286 #
UCID-17291 ..... N77-26433 #
UCID-17306 ..... N77-27018 #
UCID-17314-PT-1 ..... N77-26818 #
UCID-17316-PT-1 ..... N77-27036 #
UCID-17316-PT-2 ..... N77-27037 #
UCID-17318 ..... N77-26814 #
UCID-17340 ..... N77-27026 #
UCID-17361 ..... N77-26517 #
UCID-30040(ED.8) ..... N77-26836 #
UCID-30048-REV-3 ..... N77-26868 #
UCID-30095 ..... N77-26835 #
UCID-30133 ..... N77-26837 #
UCID-30149 ..... N77-26839 #

UCLA-ENG-7671 ..... N77-26955 #

UCRL-TRANS-11185 ..... N77-26395 #
UCRL-TRANS-11186 ..... N77-26252 #

UCRL-13695 ..... N77-26977 #
UCRL-13708 ..... N77-26488 #
UCRL-52112 ..... N77-26430 #
UCRL-52161 ..... N77-26462 #
UCRL-76203 ..... N77-26652 #
UCRL-77056 ..... N77-26938 #
UCRL-77378 ..... N77-26819 #
UCRL-77800 ..... N77-26869 #
UCRL-77999 ..... N77-26840 #
UCRL-78132 ..... N77-26461 #
UCRL-78282-REV-1 ..... N77-26870 #
UCRL-78339 ..... N77-26813 #
UCRL-78340 ..... N77-26543 #
UCRL-78360 ..... N77-26398 #
UCRL-78424 ..... N77-26255 #
UCRL-78446 ..... N77-26983 #
UCRL-78483 ..... N77-26484 #
UCRL-78500 ..... N77-26651 #
UCRL-78537 ..... N77-26487 #
UCRL-78564 ..... N77-26408 #

UDRI-TR-76-59 ..... N77-26564 #

UFD-1 ..... N77-26422 #

UFL/COEL-77/002 ..... N77-26587*#

UIEM-76-7 ..... N77-26375 #

UILU-ENG-76-2551 ..... N77-26375 #

UIUC-CAC-DN-76-198 ..... N77-26697 #

UNTA-MN-11-0002-77-1 ..... N77-27044 #

US-PATENT-APPL-SN-229143 ..... N77-26387*
US-PATENT-APPL-SN-340862 ..... N77-26387*
US-PATENT-APPL-SN-483301 ..... N77-26477*
US-PATENT-APPL-SN-583486 ..... N77-26386*
US-PATENT-APPL-SN-613004 ..... N77-26919*
US-PATENT-APPL-SN-680015 ..... N77-26797*#
US-PATENT-APPL-SN-680938 ..... N77-26942*
US-PATENT-APPL-SN-708658 ..... N77-26385*
US-PATENT-APPL-SN-796258 ..... N77-26796*#
US-PATENT-APPL-SN-799024 ..... N77-26242*#
US-PATENT-APPL-SN-807762 ..... N77-26308*#

US-PATENT-CLASS-29-597 ..... N77-26385*
US-PATENT-CLASS-29-622 ..... N77-26385*
US-PATENT-CLASS-29-628 ..... N77-26385*
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US-PATENT-CLASS-331-107A N77-26919*
US-PATENT-CLASS-333-72 ..... N77-26919*

US-PATENT-3,849,720 ..... N77-26387*
US-PATENT-4,023,266 ..... N77-26385*
US-PATENT-4,025,783 ..... N77-26942*
US-PATENT-4,025,876 ..... N77-26919*
US-PATENT-4,027,212 ..... N77-26386*
US-PATENT-4,031,389 ..... N77-26477*

USAAMRDL-TR-76-38 ..... N77-26523 #
USAAMRDL-TR-76-43 ..... N77-26129 #

USAARL-77-7 ..... N77-26130 #

USAARMDL-TR-76-40A-VOL-1 ..... N77-26123 #

USAAVSCOM-TR-76-24 ..... N77-26526 #
USAAVSCOM-TR-77-15 ..... N77-26528 #

USACS-AT-76-11 ..... N77-26844 #

USAEHA-42-0321-77 ..... N77-26507 #
USAEHA-42-0325-77 ..... N77-26508 #

USCG-D-3-77 ..... N77-26810 #
USCG-D-109-76 ..... N77-26366 #

USCIPI-660 ..... N77-26947 #

USGS/WDR/CA-75/2-VOL-2 ..... N77-26603 #
USGS/WDR/CA-75/3-VOL-3 ..... N77-26604 #
USGS/WDR/CA-75/4-VOL-4 ..... N77-26605 #
USGS/WRD/CA-75/1-VOL-1 ..... N77-26602 #
USGS/WRD/HD-74/043-VOL-3 ..... N77-26604 #
USGS/WRD/HD-76/044-VOL-4 ..... N77-26605 #
USGS/WRD/HD-76/058-VOL-2 ..... N77-26603 #
USGS/WRD/HD-76/059-VOL-1 ..... N77-26602 #

UTEC-ME-76-171 ..... N77-26642 #

UTIAS-199 ..... N77-26421 #
UTIAS-210 ..... N77-26426 #

UTRC/R76-912518-3 ..... N77-26150 #

UVA/525303/ME77/101 ..... N77-26565 #
UVA/525318/AMCS76/101 ..... N77-26895 #

VKI-TN-119 ..... N77-26885 #

VPI-E-77-17 ..... N77-26730*#
VPI-E-77-18 ..... N77-26271*#
VPI-E-77-19 ..... N77-26534*#

VU-PL-7/77 ..... N77-26479*#

WCAP-8775 ..... N77-26274 #

WHO-435 ..... N77-26754 #
WHO-448 ..... N77-27038 #
WHO-464 ..... N77-26599 #
WHO-465 ..... N77-26774 #

WORKING PAPER 5 ..... N77-26710 #

WQI-001 ..... N77-27043 #

WRE-REPT-1672(WR/D) ..... N77-26080 #

WVT-TR-77001 ..... N77-26529 #
WVT-TR-77006 ..... N77-26566 #
WVT-TR-77008 ..... N77-26918 #

W77-04202 ..... N77-26601 #
W77-05336 ..... N77-27039 #

X-530-77-72 ..... N77-26827*#
X-602-77-155 ..... N77-26425*#
X-602-77-161 ..... N77-26926*#
X-624-77-123 ..... N77-26349*#
X-660-77-144 ..... N77-27061*#
X-661-77-104 ..... N77-27050*#
X-682-77-136 ..... N77-27056*#
X-691-77-134 ..... N77-26248*#
X-921-77-63 ..... N77-26567*#

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